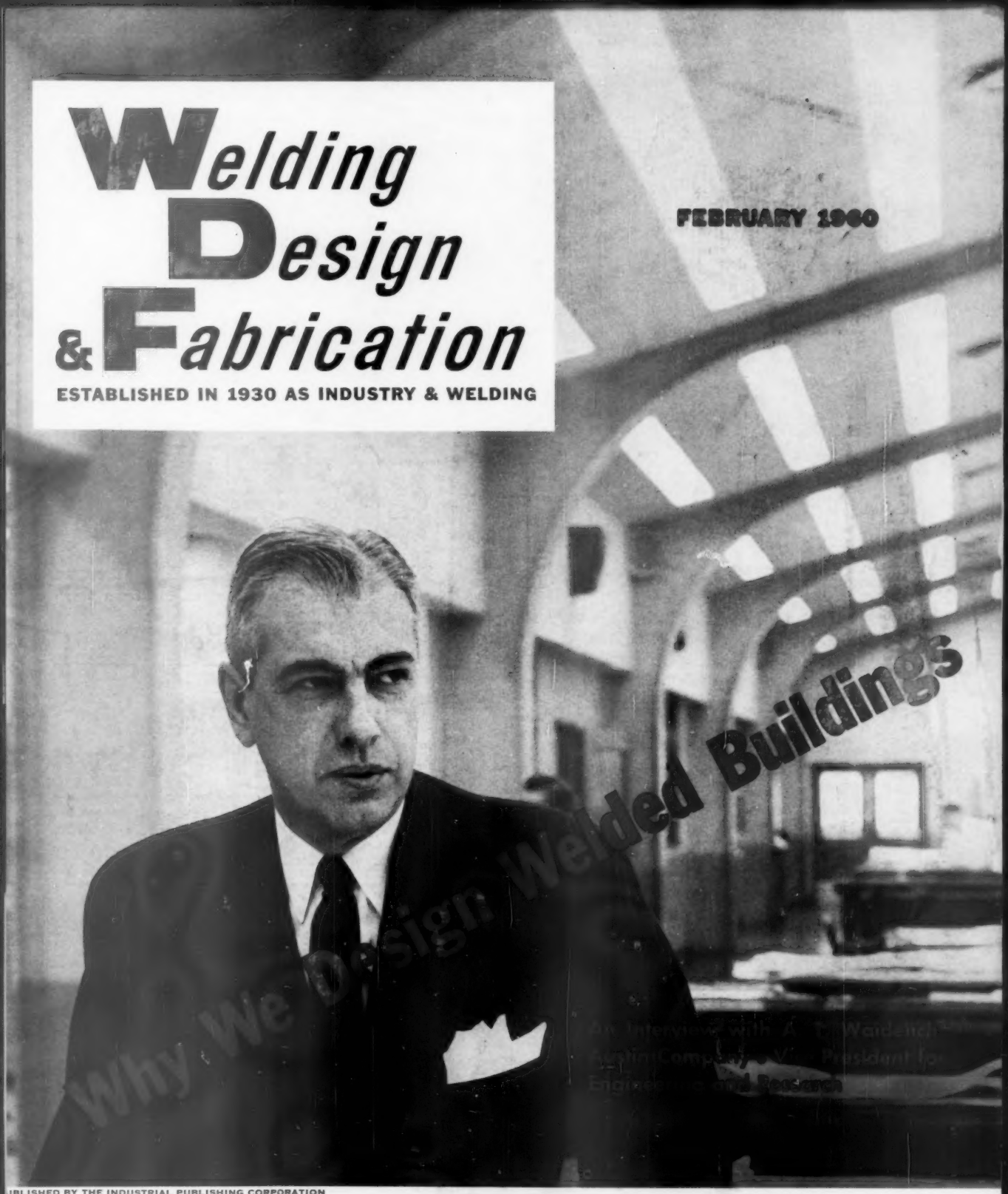
Welding Design & Fabrication

ESTABLISHED IN 1930 AS INDUSTRY & WELDING

FEBRUARY 1960



Why We Design Welded Buildings

An Interview with A. R. Wardetzky
Chief Engineer, Research and Development

PUBLISHED BY THE INDUSTRIAL PUBLISHING CORPORATION

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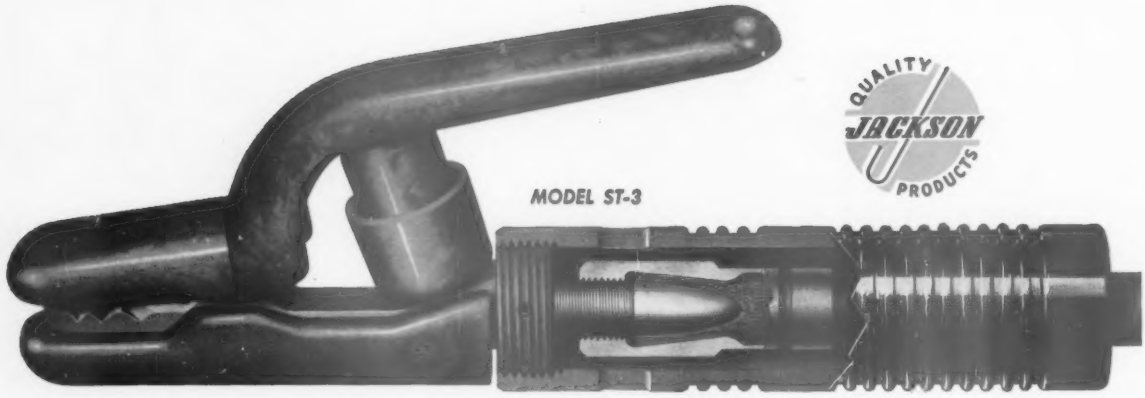
The magazine of welding management, production, and engineering



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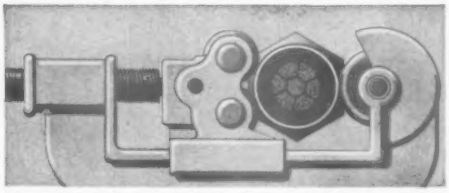
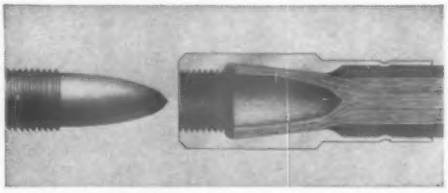
Copper alloy lower jaw terminates in a point, silver-plated for greatest conductivity. When nut is tightened, cable strands are equally disposed around this point, *Sealed Tight*.

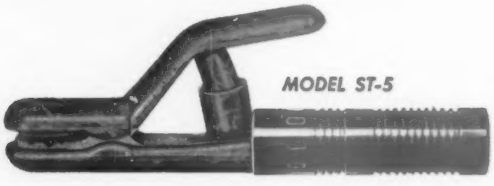
The nut extends backward, forming a ferrule around the cable jacket. This *Sealed Tight Connection Nut* is made in sizes to fit cables No. 1, 1/0, 2/0, and 3/0.



For a *truly permanent nut-to-cable connection*, the ferrule of the nut is crimped around the cable jacket, using Jackson's inexpensive, fast-acting crimping tool.



Detachable Stinger feature enables the operator to detach the "stinger end" by unscrewing it from the connection nut. The cable strands stay in place inside the nut.



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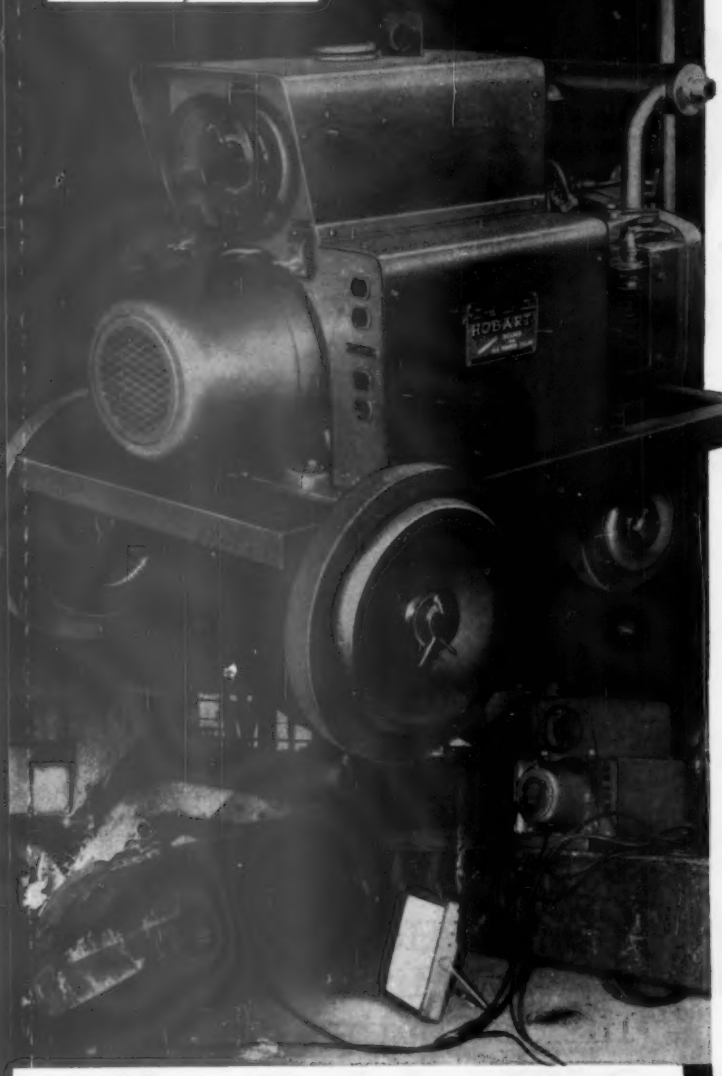

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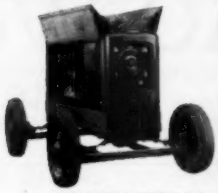

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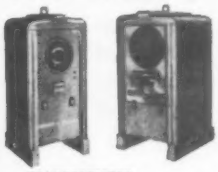

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Quick Facts

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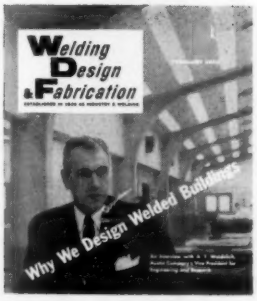
reader's guide to **Welding Design & Fabrication** *for February, 1960*



COVER: There are many advantages to welded buildings. These are explained in detail by A. T. Waidelich, vice president for engineering and research of Cleveland's Austin Company, a pioneer in the design of welded structures. Mr. Waidelich also explains why welded design sometimes takes a back seat to riveted and bolted construction and why some structural designers are slow to utilize the apparent advantages of welding. (See page 31 for the complete article.)

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Flame cutting eliminates the costly removal of excess metals by drilling, milling and bandsawing prior to final machining.

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Face lifting an old building to provide modern quarters for a TV station posed many structural problems. Here's how welding helped solve them.

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Here's what one company does to get high quality welded joints in feedwater heaters for electric generating stations.

63 DEVELOPMENTS IN CONSUMABLE ELECTRODE WELDING OF MAGNESIUM

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67 NEW WELDING TECHNIQUES SAVE $5,000 A YEAR

Semi-automatic welding has replaced two manual processes in welding steam generator components; savings in labor and shielding gas have resulted.

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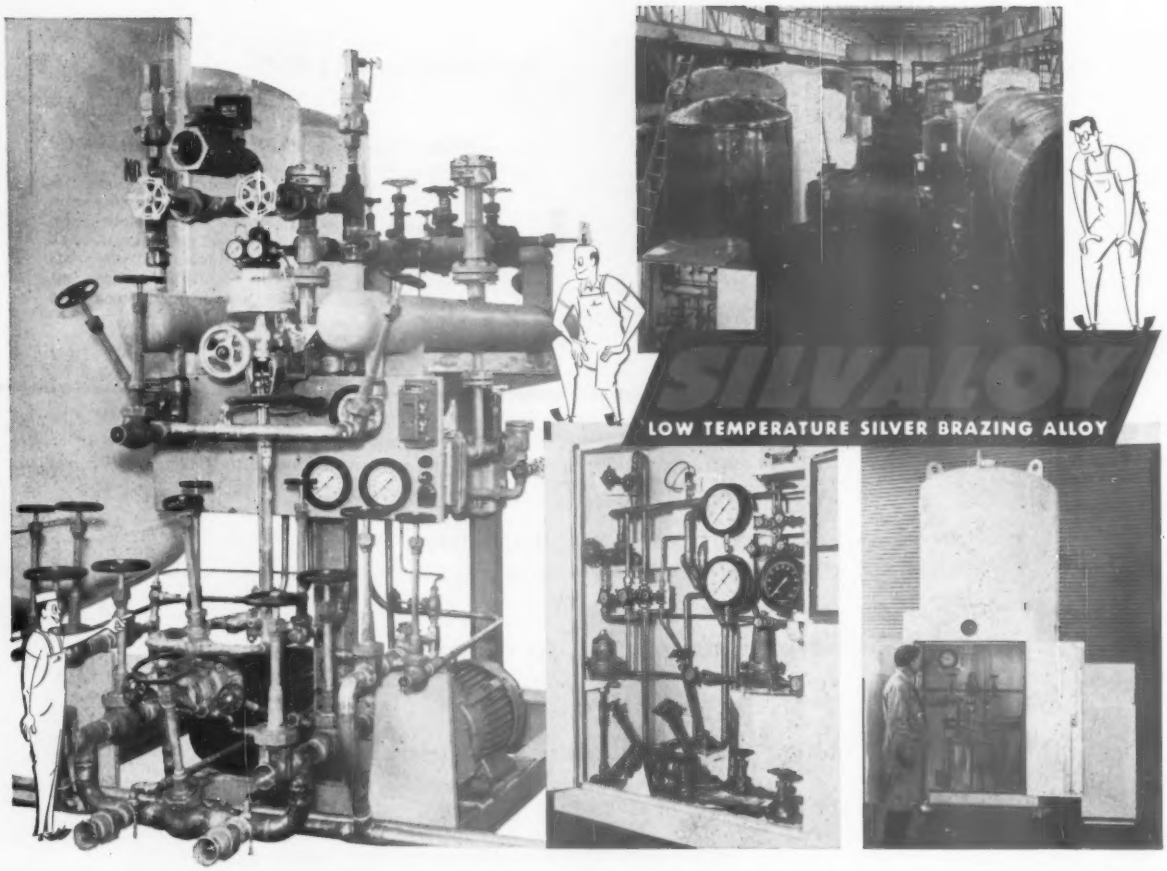

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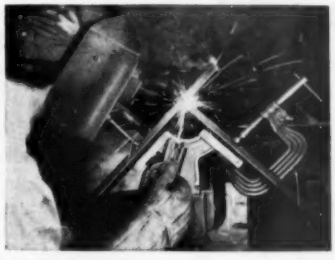

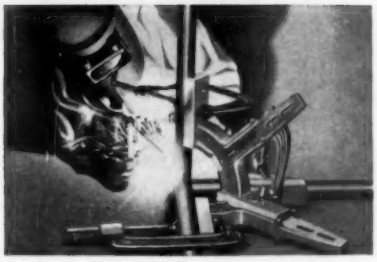

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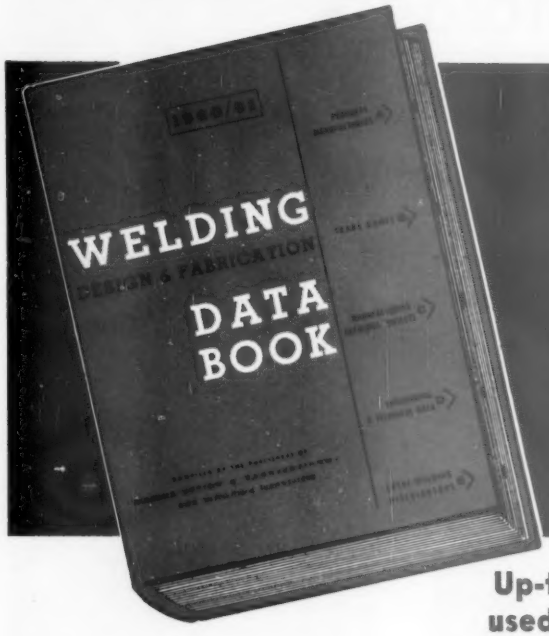

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WELDING AT WORK

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Welding builds first guided missile-launching destroyer

BATH, MAINE: The Navy's first guided missile-launching destroyer was welded with Alloy Rods Company's Atom-Arc iron powder low-hydrogen electrodes (E-7018) and Arcaloy stainless steel electrodes (Type 310), according to a news release from the Navy's First District Public Information Office.

The USS Dewey (DLG-14) is the first of the Navy's newest and largest class of destroyers. The 5600-ton destroyer leader displaces 1,000 tons more water and is 50-feet longer than any previous destroyer-type ship. Its armament includes the latest in anti-submarine guided missiles and rockets.

The ship's superstructure and mast are made of aluminum; this reduces the weight of that area by two-thirds.

Reliance Electric and Engineering Co., Cleveland, Ohio, furnished motors and controllers for various equipment on the ship.

Portable X-ray unit for pipeline inspection

X-RAY INSPECTION of pipeline sections and window welds is easy with new lightweight, portable equipment like the unit shown here in use on a municipal central steam pipeline job. In this set-up, the window welds being inspected were located at a pipeline vertical offset which brought the pipe to within only a few feet of the surface. City block-long distances of pipe were installed at depths varying from a few feet to 10-feet below the street surface. Use of high voltage portable X-ray equipment, like General Electric's LX-140 unit shown, makes inspection of these weldments possible in places where larger, bulkier equipment would be impractical.

The unit weighs 46¼ pounds and has a continuous range of 70 to 140 kvp available. The control unit (upper left) weighs 25 pounds.

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REUBEN STANLEY SMITH, OF MILWAUKEE, WISCONSIN.

ELECTRODE FOR ARC-WELDING.

1,301,331. Specification of Letters Patent. **Patented Apr. 22, 1919.**

Application filed December 6, 1918. Serial No. 265,524.

To all whom it may concern:

Be it known that I, REUBEN STANLEY SMITH, a citizen of the United States, residing in the city of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful improvement in Electrodes for Arc-Welding, and do hereby declare that the following is a full, clear, and exact description of the invention which will enable persons skilled in the art to which the invention pertains to make and use the same.

This invention relates to electrodes for electric arc welding, and has for its object to provide an electrode which may be used with ease and certainty in the production of satisfactory welds.

In carrying out my invention, the wire constituting the electrode will be covered by winding thereon a sheet of paper, having a width sufficient to cover the electrode to the desired thickness for the electrode when wound thereon. The width of the sheet of paper and the consequent number of convolutions about the wire will be in proportion to the gage of the wire used for the electrode, which latter is determined by the character of the surfaces to be welded. In another form, the wrapping about the wire will be formed as a strip from a comparatively narrow strip of paper, or a multiple number of strips of paper, simultaneously wound, may be used. The sheet or strip of paper used as a covering is saturated or impregnated with sodium silicate, or other heat resisting compound, and such saturation may be effected by passing the paper with the solution prior to winding the paper about the wire, or the electrode after being covered with paper, may be placed in an ordinary vacuum impregnating apparatus to enable the necessary saturation to take place. After saturation, the electrode will be baked to expel a part of the moisture and harden the surface of the

Through research ...a better way

A.O.Smith

CORPORATION

WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin

A. O. Smith INTERNATIONAL S.A.,

Milwaukee 1, Wisconsin, U. S. A.

...WELDING IS OUR BUSINESS

Are you paying

5 TO 10 TIMES TOO MUCH FOR WELD INSPECTION

. . . . and not finding ALL the cracks?

If you are testing to routine specifications—or applying such specs—it is quite likely that you are paying an unnecessary high price. Certainly it is a possibility worth investigating!

With Magnaflux testing . . .

you can reliably inspect about 150 feet of linear welds per hour, at a cost of approximately 4.4¢ per foot of weld. This includes man-hour cost for two inspectors working at an *average* rate, plus the small cost of Magnaflux powder used.

For non-linear welds, your cost will be about 50% more—or roughly 6.6¢ per foot of weld, including normal cost and time for moving scaffolding.

Compare these costs with what you are paying now!

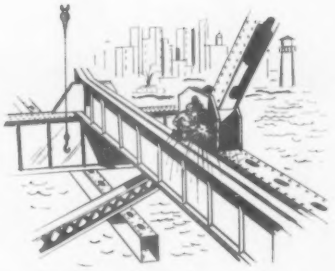
How reliable is Magnaflux?

It is the only recognized test proven completely reliable for finding all cracks open to the surface . . . however small or deep. These are the cracks that raise stresses dangerously and cause most of the failures in weldments.

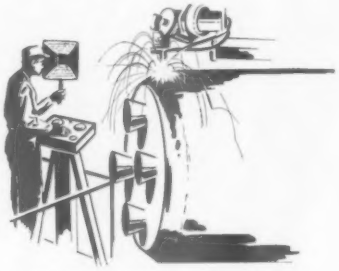
Many manufacturers of X-ray equipment frankly caution that X-ray may not find all these cracks. Yet, these very cracks are most important to find! Nor will *any other method* find them at a cost as low as Magnaflux.

None of this implies that Magnaflux testing eliminates all need for other test methods. Magnaflux *can* cut your testing costs and it *will* find many cracks other methods overlook, and the significant sub-surface defects, as well.

Shouldn't you investigate these savings now? Ask to have a Magnaflux Engineer detail the whole story—soon.

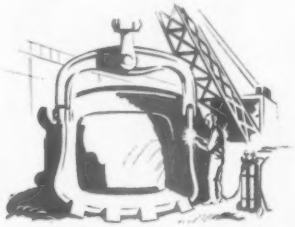


CONSTRUCTION: Bridges, buildings, etc. Magnaflux is proved out on important welds.



SPACECRAFT: Critical welds. Often several Magnaflux and other methods needed—on each weld.

OIL and CHEMICAL: For pipeline, reactor, or tank—welds proved crack-free.



HEAVY EQUIPMENT: Manufacture and Repair. Portable and low cost reliable tests.

MAGNAFLUX CORPORATION

A Subsidiary of General Mills

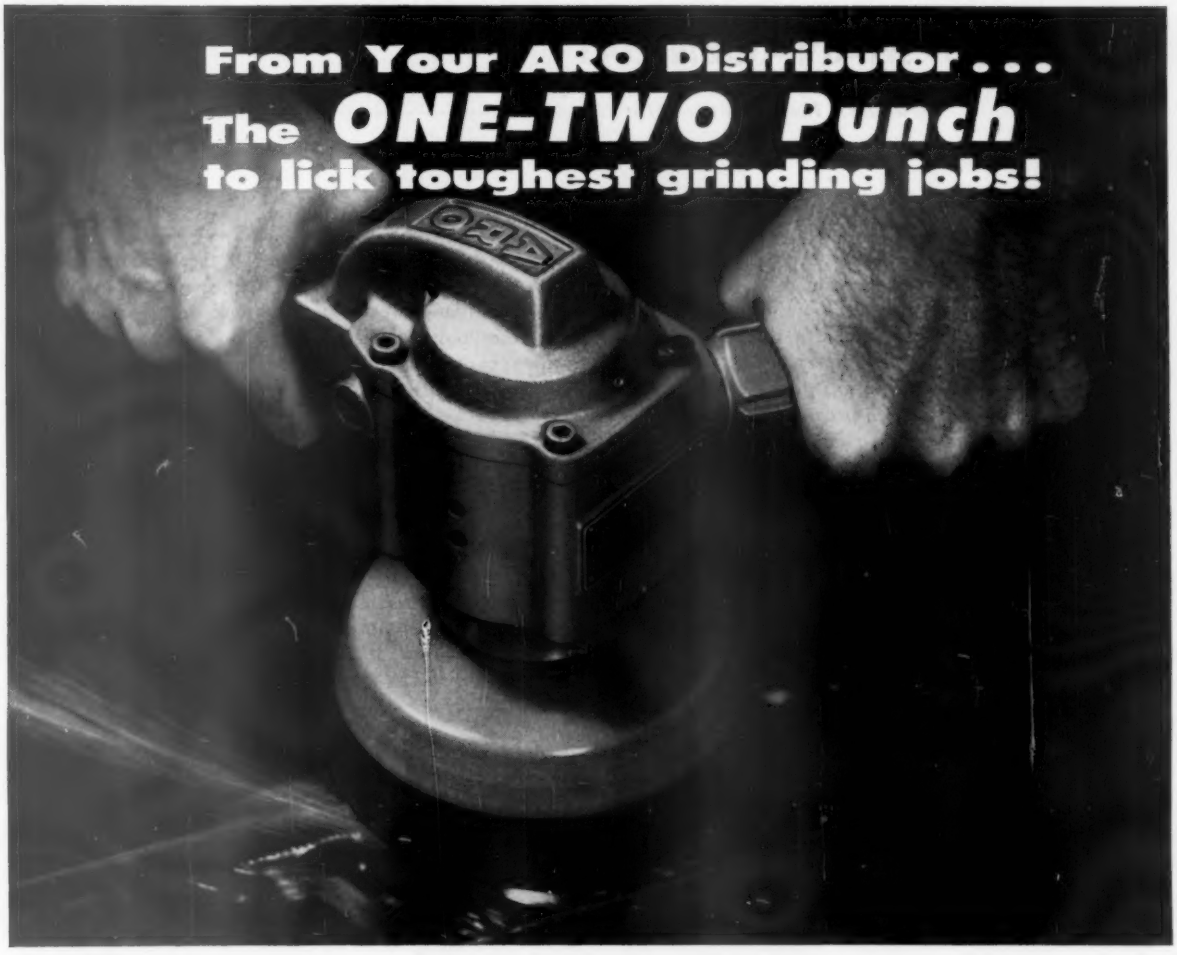
7348 West Lawrence Avenue, Chicago 31, Illinois

New York 36 · Pittsburgh 36 · Cleveland 15

Detroit 11 · Dallas 35 · Los Angeles 22

The Hallmark of Quality in nondestructive test systems

For More Information Circle No. 47 on Reader Service Card.



1

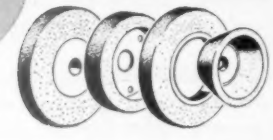
NEW ARO COMPACT
8300 SERIES VERTICAL GRINDERS

ARO's powerful new 8300 Series Grinders are plenty long on muscle and hustle . . . to make short work of your toughest grinding jobs. Yet they weigh in at only seven pounds—handle with ease—and maintain accurate speed from start to finish. Features include unitized motor, safety throttle, and low-level noise. Solid ARO quality throughout. Team ARO 8300's with quality abrasives to cut your grinding costs. Both are available from one convenient source—your ARO Distributor. Ask him about job-testing an ARO 8300 soon!

- Compact, powerful.
- 4500, 6000, 8000 r.p.m.
- Weigh only 7 lbs.
- Maintain accurate speed.
- Use with up to 6" wheels.

2

THE RIGHT ABRASIVE WHEELS



See your ARO Distributor for expert help in choosing the correct wheel for each grinding job. He has a complete selection of standard cup wheels, depressed-center wheels and sanding discs to give you peak efficiency with the new ARO 8300 grinders. Call him today!

THE ARO EQUIPMENT CORPORATION
Bryan, Ohio
Aro of California, 3141 S Grand Ave Los Angeles 7, Calif.
Aro Equipment of Canada Ltd., Rexdale (Toronto), Ontario
Offices in All Principal Cities

ARO®
AIR TOOLS
Also Air Hoists, Automation Tools

For More Information Circle No. 12 on Reader Service Card.

WELDING MANAGEMENT

watches these developments

"WELDING CANNOT TAKE *its proper place as an engineering tool unless means are provided for conveying the information from the designer to the workmen." That's the statement made in the introduction to the recently published revised version of the American Standard Graphical Symbols for Welding. The introduction continues, "Such practices as writing 'To be welded throughout' or 'To be completely welded' on a drawing in effect transfer the design of all attachments and connections from the designer to the operator, who cannot be expected to know what strengths is necessary. This practice in addition to being dangerous, may also be costly for certain shops, which, in their desire to be safe, use much more welding than is necessary."*

FABRICATION OF SPECIAL HEAT EXCHANGERS and coolers for the Dreadnought, Britain's first nuclear-powered submarine will be done by Alco Products, Inc., Schenectady 5, New York. The vessel will be modeled after the U. S. Navy's nuclear submarine Skipjack. The equipment to be furnished by Alco will be part of a complete Skipjack-class submarine nuclear propulsion plant that the United States has authorized for transfer to the United Kingdom.

FOUR NEW STANDARDS *have been included in NEMA Standards Publication (EW 1-1955) for Electric Arc-welding Machines and Electrodes. These standards are listed in Part 3 (Welding Electrodes) of that publication and include sections on: diameters of bare welding rods and electrodes, lengths of bare rods and electrodes, weights for bare welding rods and electrodes on spools and spool and winding requirements.*

STRONGER ALLOYS designed to more exact specifications may be the result of research reported by a Battelle Memorial Institute scientist. Dr. Ervin E. Underwood describes new findings on the strength of experimental aluminum-copper alloys that may have application to more complex commercial alloys.

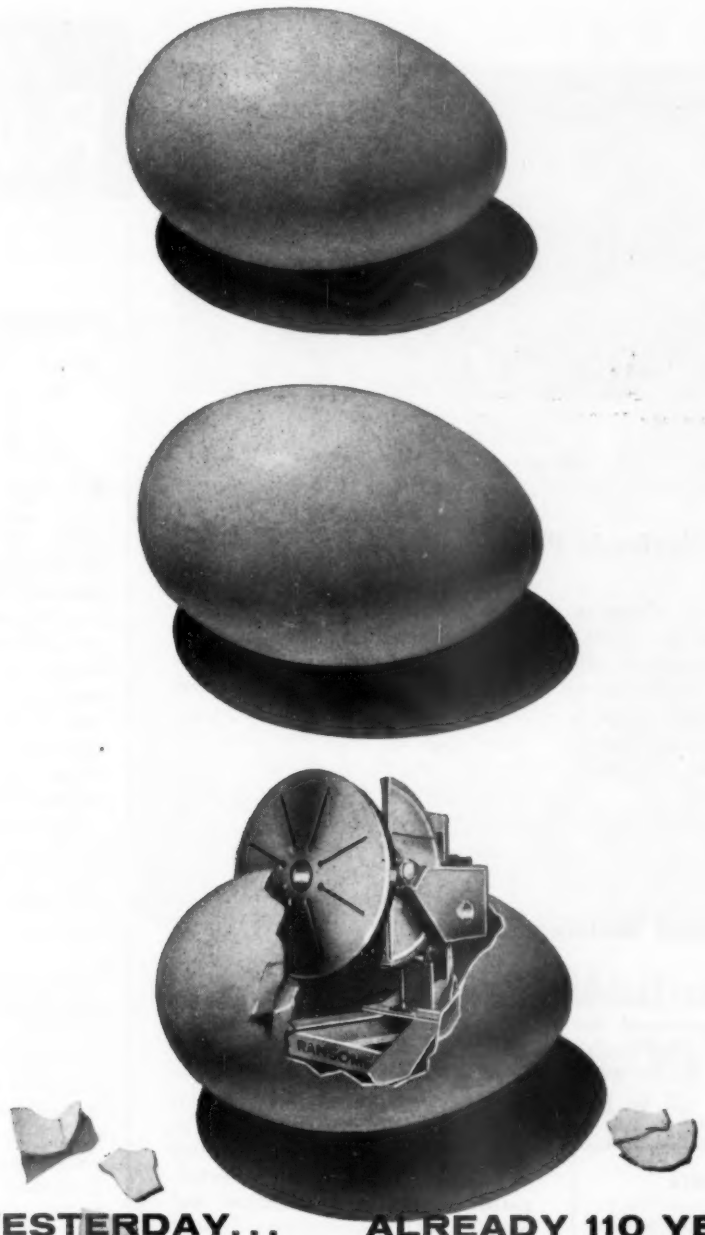
The most important factor in strengthening high-temperature, high-strength alloys is usually the fine metallic particles dispersed throughout the alloys. Until recently it was assumed that the closer the spacing the greater the strengthening, with the alloy becoming weaker if space between particles decreased. Battelle investigations disclose the fact—unsuspected in theory or practice—that although increased spacing means increased weakness, this trend reverses itself at a certain point. When spacing is increased to this critical pont, strength begins to increase again, reaches a peak with further spacing, and again declines.

MONTHLY STATISTICS *compiled by the Resistance Welder Manufacturers Association show that as of November 30th, new business during 1959 was running 38 percent over orders for the same period in 1958. A gain of 25 percent was also reflected in shipments for the first 11 months of 1959 in comparison with a similar period in 1958. At the end of November, RWMA members reported backlogs of more than $91½-million, the highest figure in 1959.*

STANDARDIZATION is the subject of a recently published report of a survey conducted on the organization, costs and savings of standardization activities in American industry. The American Standards Association reports that 238 company responses were analyzed. Among these, 34 companies reported specific dollar savings ranging from $6000 to $1,000,000 annually. More than 200 reported some kinds of standards activities. Practically all of those companies reporting dollar savings also reported extensive use of standards and standards manuals. This seems to indicate, the ASA report says, that there is a close link between organized standards work and recordable cost savings. However, the over-all report concludes a majority of American companies does not fully realize the cost savings potential of standardization.

THE STEELMAKING CAPACITY *in the United States increased 937,000 net tons in the past year—to a record 148,570,970 tons annually, as of January 1, 1960, according to the American Iron & Steel Institute. The capacity gain was the 13th annual increase in a row. It was achieved despite the long, nationwide strike which forced some companies to stop work on expansion projects.*

The new, nearly 148.6 million-ton figure (the annual capacity for the output of ingots and steel for castings) is 62 percent higher than the potential at the end of World War II, and is over 31 million tons above the steel industry's greatest annual capacity, totaling 117 million tons during 1955.



HATCHED YESTERDAY... ALREADY 110 YEARS OLD

1850-1943: Ransome Machinery Company was born and rapidly developed a reputation for quality and engineering in fine machinery. In 1932, Ransome perceived the need to free the weldor from the burden of "down time" and permit continuous downhand welding — pioneered the *first* commercial welding positioner — thereby created a new technology in the welding industry.**1943-1959:** Ransome Machinery Company became a subsidiary of Worthington Corporation and continued to develop the finest in welding positioning equipment. **TODAY:** Having acquired Worthington's positioning equipment business, the old reliable name, Ransome, rises again with renewed vigor . . . totally independent, newly organized with top veterans from Worthington and eager young talents. *Dedicated to its heritage, the* new *Ransome pledges to apply the old Ransome traditions of quality and creative imagination to serve your modern requirements in automation welding.*

Ransome Company

SCOTCH PLAINS, New Jersey

RANSOME...THE PIONEER IN POSITIONING FOR WELDING

For More Information Circle No. 58 on Reader Service Card.

RULED-IN-LINES show where new 30,000 square foot electrode production area will be added as . . .

McKay Expands Electrode Plant In York, Pa.

YORK, PA.: The McKay Company has broken ground here for a $500,000 expansion program which will include new facilities for manufacturing the company's line of mild, stainless and hard surfacing welding electrodes, and automatic and semi-automatic welding wires.

A new building of about 30,000 square feet is being added to existing facilities. New manufacturing facilities being installed include special high-speed, high-temperature electrode drying and baking equipment. Included in the expansion is a new welding research laboratory.

Facilities are expected to be completed sometime in April.

A.W.S. Plans Annual Welding Exposition

NEW YORK CITY: The American Welding Society has announced that 85 percent of available space has already been sold for its Annual Welding Exposition which will be held April 26-28, in the Great Western Exhibit Center in Los Angeles.

Fred L. Plummer, National Secretary of the Society, predicted the Los Angeles Show would be the biggest in AWS history. "In 1959," he said, "we needed 35,000 square feet to house exhibits. In 1960 we anticipated an even greater demand and reserved 42,000 square feet. Now it looks as though we may need 50,000 square feet." A hall with 150,000 square feet of floor space would be required to house 50,000 square feet of exhibits.

Over two million dollars worth of equipment and materials will be displayed next April. New welding processes will be demonstrated.

A technical meeting will be held concurrently, April 25-29, at the Biltmore Hotel, Los Angeles. The American Welding Society will sponsor 19 technical sessions, consisting of 57 papers; the American Society of Mechanical Engineers will sponsor four sessions, consisting of 12 papers.

COMING EVENTS

February 3-4: Midwest Welding Conference, Armour Research Foundation of Illinois Institute of Technology, Chicago.

April 25-29: Annual Meeting and Welding Exposition, American Welding Society, Los Angeles.

May 5-7: Annual Convention, National Welding Supply Association, Palmer House Hotel, Chicago.

May 9-10: Annual Convention, International Acetylene Association, San Francisco.

May 9-13: 2nd Southwestern Metal Congress and Exposition, American Society for Metals, Dallas, Texas.

October 13-15: Western Welding Technical Conference and Welding Show, Santa Clara Valley Section, AWS, San Jose, Calif.

About RWMA

by
W. H. CARRIGAN
president
Resistance Welder Manufacturers Association

Since its inception in 1937, the Resistance Welder Manufacturers' Association has devoted considerable of its energies and finances towards the advancement of resistance welding techniques and the dissemination of technical information. To make this possible, member companies have volunteered their technical and research staffs.

To enable the metal fabricating industries to train their engineers and shop foremen in the latest resistance welding practices, the Association has embraced a broad program of education for users and for engineering colleges and technical schools.

RWMA has published a *Resistance Welding Manual*, which is a complete and authoritative textbook on all phases and applications of resistance welding. Currently, 21 educational bulletins are also distributed widely by the Association's office and new ones are constantly being added.

The Association's visual education program includes three films—"*This Is Resistance Welding*", "*Resistance Welding*" and "*Resistance Welding of Stainless Steel*", all of which may be borrowed without charge by industries, engineering schools, societies and the general public.

Proper instruction for technical students, plant personnel and engineers has always been

continued on page 73

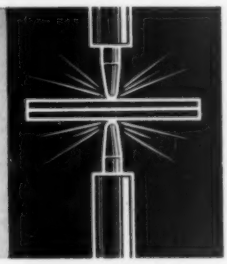
RIGHT . . . in every shape and size

P.R MALLORY & CO Inc

MALLORY MEMOS

NEWS AND TIPS ON RESISTANCE WELDING

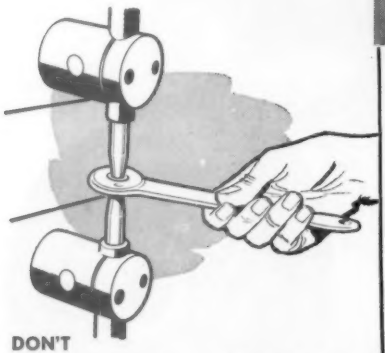
P. R. Mallory & Co. Inc., Indianapolis 6, Indiana



WELDING HINTS

DO

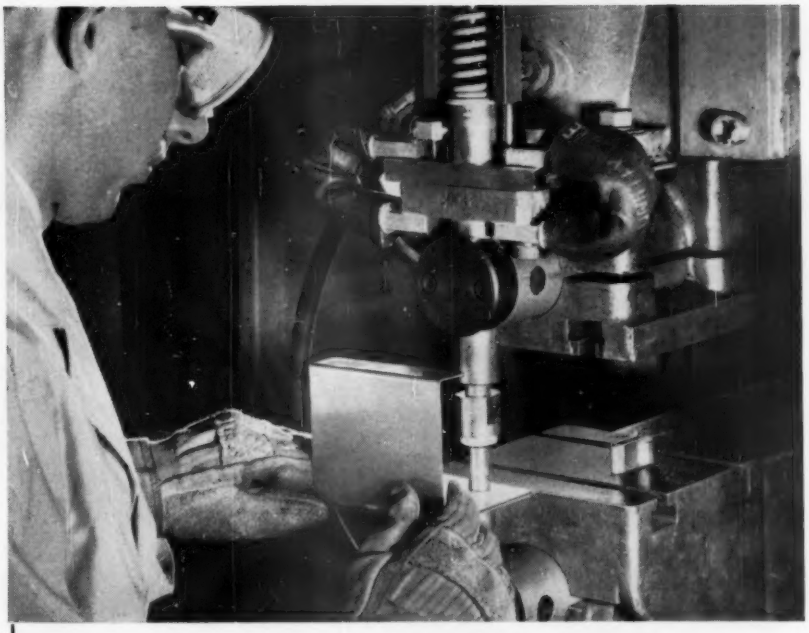
Keep the tip taper and holder taper clean, smooth and free from foreign deposits. You'll get a "first-class" weld every time with a minimum of arcing. For best results, use precision-machined Mallory tips and holders.



DON'T

Never permit spot welding tip to mushroom enough to make dressing difficult—better to dress it regularly to be sure of getting consistently good welds.

Send for this useful chart of 34 Do's and Don'ts for Resistance Welding. Hang it on the wall in your shop for handy reference.



To Weld Quick-Melting Metals Use MALLORY Low-Inertia Holders

Yellow brass, red brass, aluminum and similar metals are tricky to spot or projection weld. They change so quickly from a solid to liquid state that the sudden loss of pressure often causes burning or flashing at the weld.

Mallory low-inertia holders solve this problem by giving you a quick, low-friction follow-up of pressure. You can select the pressure you need, just by interchanging springs . . . done in seconds. Our new line of low-inertia water-cooled holders give you these features:

- bearing support close to pressure application
- rapid pressure follow-up, low friction
- wider pressure range
- no current conduction between sliding members
- rugged construction
- interchangeable electrode adapters
- easily maintained in your own shop
- efficiently water cooled
- horizontally rotating cables for maximum clearance

Low-inertia holders are also useful for cross wire welding of non-ferrous materials where multiple spots are desired. They make your big welding machines more versatile by adapting them to low pressure or low-inertia welding. They're part of the extensive Mallory line of standardized holders, electrodes, welding wheels, and supplies.

Mallory welding products are available from authorized distributors located in all principal cities.

For More Information Circle No. 48 on Reader Service Card.

RIGHT . . . in every shape and size

for fast action and long life

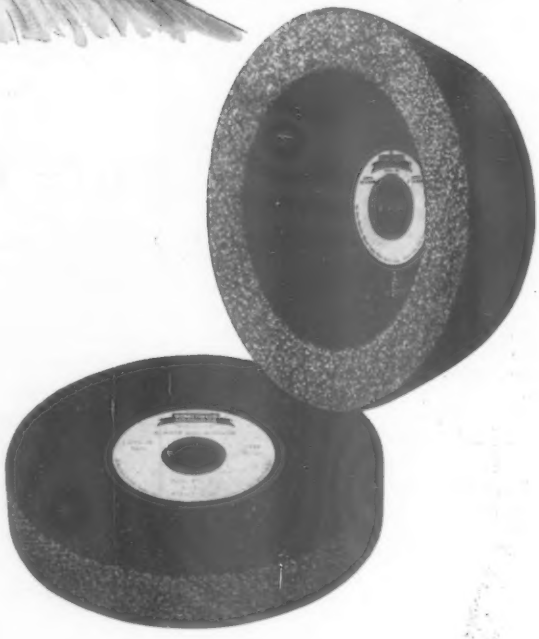
SIMONDS SNAGGING WHEELS

FOR WELD GRINDING

Right for you . . . for rapid metal removal and long wheel life. With Simonds snagging wheels, that is *consistently* true, from order to order. They're made for all portable grinders . . . air, electric or flexible shaft . . . straight wheels, cup wheels, cones and depressed center wheels. Resinoid bonded for high speeds up to 9,500 s.f.p.m. Vitrified bonded for regular or low speeds up to 6,500 s.f.p.m.

Improved resinoid bond contains an internal lubricant consisting of special chemicals and compounds added to the wheel mix for improved grinding action.

Write for Bulletin ESA-304



SIMONDS ABRASIVE CO.

Tacony & Fraley Sts.
PHILADELPHIA 37, PENNA.
Division of Simonds Saw and Steel Co.

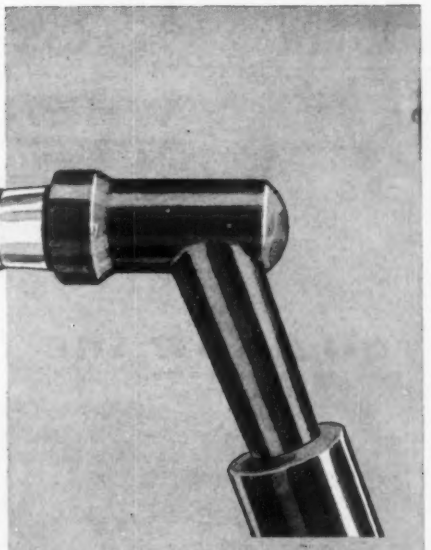
COUNT ON / YOUR SIMONDS DISTRIBUTOR
FAST SERVICE • LOCAL STOCKS

WEST COAST PLANT: EL MONTE, CALIF.—BRANCHES: CHICAGO • DETROIT • LOS ANGELES • PHILADELPHIA • PORTLAND, ORE. • SAN FRANCISCO
SHREVEPORT—IN CANADA: GRINDING WHEELS DIVISION, SIMONDS CANADA SAW CO., LTD., BROCKVILLE, ONTARIO • ABRASIVE PLANT, ARVIDA, QUEBEC

For More Information Circle No. 70 on Reader Service Card.

NEW NEW NEW NEW NEW NEW NEW NEW NEW ! MEN ON THE MOVE

the TOP TIG welding TRIO

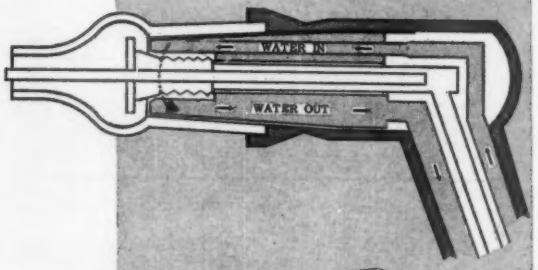


the torch

TEC VISUWELD TORCH

The proven tungsten inert gas welding torch contains all these exclusive features: the lightest weight... only 3 ounces... maintenance free... no parts to wear or leak... 3 to 350 amps.... topped with a Visuweld transparent gas nozzle which presents a clear, unobstructed view of the weld area at all times.

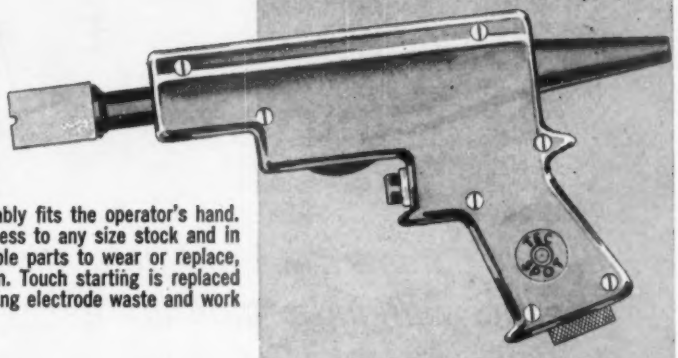
Unparalleled tip-of-the-torch cooling system continuously releases cool water where it's needed most... at the tip-of-the-torch. Guaranteed gas and water leakproof due to one piece torch head construction without "O" rings, threads, or gaskets.



the gun

TEC SPOT GUN

This TIG spot welding tool perfectly bridges the gap between resistance welding and TIG arc welding. The TEC Spot Gun has been designed to increase production output and replace expensive spot welding operations. The lightest weight, most compact spot gun ever made, it comfortably fits the operator's hand. Weld up to, and including ⅛" thickness to any size stock and in any joint design. There are no movable parts to wear or replace, permitting maintenance free operation. Touch starting is replaced by high frequency arc starting, reducing electrode waste and work contamination.



the control

TEC SPOT CONTROL

This perfect welding mate for the TEC Spot Gun, converts any DC power source into a new TIG spot welding machine. A choice of preset welding times can be selected at the gun itself. The TEC spot control unit is light and compact, with easy to read controls. It is the only control unit of its kind. This portable TEC spot control unit can easily be connected to any DC power source.

all from —TEC

Write for full information

TEC TORCH COMPANY, INC.

300 PATERSON AVE., CARLSTADT, N. J.

For More Information Circle No. 73 on Reader Service Card.

NEW NEW NEW NEW NEW NEW NEW NEW NEW

WHEN IT

MELTS

you know the *temperature!*

the easy modern way to determine exact working temperatures!

Just mark or stroke the surface with THERMOMELT . . . when it reaches the desired temperature, the mark liquefies. There's no guesswork, no wasted time or material . . . THERMOMELT is the quick, precise way to determine heating temperatures. Accurate to within ±1%.

A STIK FOR EVERY TEMPERATURE from 113°F. to 2000°F.

ALSO AVAILABLE IN LIQUIDS AND PELLETS for inaccessible or hard-to-measure applications. Wide range of temperatures.

Send today for free THERMOMELT literature and pellet sample (indicate temperature desired).

MADE BY THE MANUFACTURERS OF MARKAL PAINTSTIK MARKERS AND PROTECTIVE COATINGS

MARKAL COMPANY 3063 West Carroll Avenue, Chicago 12, Illinois

For More Information Circle No. 46 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

PROMOTIONS:

T. F. O'Connell has been named general sales manager, Distributor Products Department of *Linde Company, Division of Union Carbide Corp.* Prior to his last previous assignment as Pacific Coast Manager for Linde in 1957, Mr. O'Connell was successively Linde District Manager at St. Louis, Indianapolis and Detroit.

Jean J. Revelt has been named Public Relations Assistant by the *Lincoln Electric Co.* He had held the position of welding engineer in Lincoln's Milwaukee District for the past eight years.

F. Howard Cobb, who had been Cincinnati, Ohio, resident salesman for two years, has been appointed to the position of district sales manager, Houston, Texas, by *Page Steel & Wire Division, American Chain & Cable Co., Inc.*, Monessen, Pa.

Robert L. VanHorn has been appointed regional sales assistant in Chicago, according to H. H. Comstock, manager of the Midwest region of *National Cylinder Gas Division of Chemetron Corp.*

HONORS:

J. S. McKeighan, Milwaukee District Manager for *Lincoln Electric Co.*, has been named "Man-of-the-Year" of the Lincoln sales engineering organization. McKeighan was cited for his leadership and management under which sales of Lincoln welding equipment, electrodes and accessories increased to 146 percent of the 1958 period.

continued on page 20

Belden Welding Cable
the Complete Line

O.T.R. Rubber-Jacketed Cables
Oil-tempered rubber gives the best balance between easy handling, flexibility, and resistance to the effects of oil, heat, cold, and mechanical abuse.

Neoprene-Jacketed Cables
Resist oil, grease, heat, sunlight, mechanical abuse, and ozone set up by high frequency welding or atmospheric conditions.

HVF Vinyl Plastic-Jacketed Cables
High voltage-frequency vinyl insulation affords perfect resistance to corona and ozone cracking . . makes this cable ideal for high frequency welding. High resistance to abrasion, oil, and impact.

Whip Lead Cables
Hawser lay construction of conductor makes this cable extremely limp and manageable . . minimizes operator fatigue. Jacket won't pull away from electrode holder. Neoprene insulation.

plus rubber-jacketed welder power supply cords

ask your welding supply distributor

one wire source for everything electrical and electronic

magnet wire • lead wire • power supply cords • cord sets • portable cordage • electronic wire • automotive replacement wire and cable • aircraft wire • electrical household replacement cords

Belden
WIREMAKER FOR INDUSTRY
SINCE 1902
CHICAGO

18-1-9

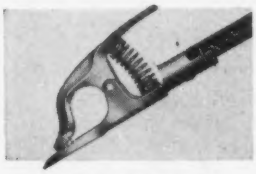
you do... with these NEW

SuperGrip®

GROUND CLAMPS

Model L—500 Amps.

Model M—300 Amps.



Model S—200 Amps.

Quick and "handy" grounding speeds up the welding job and a positive connection saves welding power to produce more welding work per day. These new *SuperGrip* GROUND CLAMPS were designed by the industry's most experienced manufacturer of welding and safety equipment.

check these outstanding features:

EXTENDED LOWER LIP for easy clamping with quick "under and on" motion.

BALL POINT SET SCREW of "man size" diameter grips cable tightly for full cross-section connection.

CABLE SUPPORT LIP offers added wrap area to minimize strand breakage.

POWERFUL COMPRESSION of spring gives maximum "bite"... with spring fully insulated from grips.

BROAD, FLAT BASE JAW and heavy teeth offer large contact area for positive connection.

ASK YOUR WELDING DISTRIBUTOR *or write for Bulletin No. T2-R*

The FIBRE-METAL Products Company | CHESTER PENNA

In CANADA: Fibre-Metal (Canada) Limited, Toronto

For More Information Circle No. 26 on Reader Service Card.

MEN ON THE MOVE

continued from page 18

APPOINTMENTS:

CHATTERTON

BALDWIN

Paul Chatterton has joined the sales department of *Fibre-Metal Pacific*, Bell Gardens, Calif. He will cover Washington, Oregon and Idaho, calling on welding and safety equipment distributors on a wholesale basis.

Jackson Products, Air Reduction Sales Co., Warren, Michigan, has appointed **Thomas J. Baldwin** Southeastern Zone representative with headquarters in Birmingham.

Francis P. Iapalucci has been named plant manager of *Lake Erie Machinery Corp.*, Buffalo, N. Y. He has been active in American Welding Society activities and is the author of several technical papers on welding and plant operation.

Harley W. Weide has been named district representative of the Southwestern States for *Hobart Brothers Co.*, Troy, Ohio. He will cover Southern California, Arizona and New Mexico.

James M. E. Tildesley has been named General Manager of *Eutectic Welding Alloys Co. of Canada, Ltd.* Mr. Tildesley will be located at the Company's newly opened plant and head office building at 5051 Cote de Liesse Road, St. Laurent, Montreal, Quebec.

William Dobranski has been named Western District Sales Manager by *K-G Equipment Co., Inc.* Allentown, Pa. Mr. Dobranski will head K-G's California Sales and Warehouse Division in Los Angeles.

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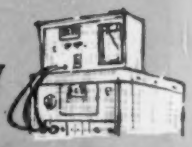

with P&H punched-tape control. Both are infinitely versatile and standardize weld quality at levels

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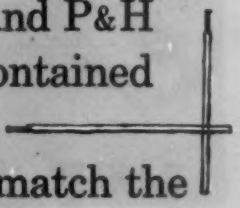

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LIBRARY

of welding

Notch Sensitivity Tests

"Testing for Notch Sensitivity in Welded Joints," C. E. Hartbower, Watertown Arsenal, U. S. Army Ordnance Corps. (No Date) 24-pages. (Order PB 151630 from OTS, U.S. Department of Commerce, Washington 25, D. C., 75 cents.)

A critical review of selected papers dealing with the evaluation of notch toughness in steel by means of the V notch Charpy impact test is presented. Past objections of metallurgists and designers to this particular test are discussed. The study's purpose was to show that it is possible to evaluate notch toughness in a welded joint as well as in the unwelded base metal.

The study concludes that the V notch Charpy impact test provides an excellent means of evaluating the relative toughness of weld, heat affected zone, and base metal, providing that certain procedures are followed and that a significant criterion of performance and definition of temperature are selected. Methods for accurately accomplishing these evaluations are presented.

Welding Nuclear Power Piping

American Welding Society, Department T, 33 West 39th Street, New York 13, N. Y.; $1.50.

The first national publication on welding ferrous materials for nuclear power piping operations has been published by the American Welding Society. The 20-page report was compiled by nuclear power experts. It represents their combined knowledge of the best methods and procedures to be used in this new industry.

An AWS Committee spent two years examining methods and practices and sifting information from nuclear power engineers before compiling the report.

The material includes: welding procedures, detailed sketches of operations, joint design—angles and dimensions, quality control, qualification of procedures, qualification of welders and inspection methods.

continued on page 26

So versatile it joins Nickel to 304, Nickel to mild steel equally well! It's Inco-Weld "A"!

Same unique Inco welding product (electrode or wire) successfully welds 97% of all dissimilar alloy combinations.

The weldor pictured above is TIG welding a 9/16-inch Grade "A" Nickel bottom shell to a 5/32-inch Type 304 (18/8) stainless steel outer shell to complete a 600-gallon steam-jacketed kettle.

When the picture was taken, the fabricator, J. C. Pardo & Son of Schenectady, N. Y. was also completing a similar kettle formed of Nickel and mild steel.

In *both* jobs, joining procedures and materials were *exactly* the same . . . initial tacking with Inco-Weld* "A" Electrode (that's the one with the green flux coating) . . . finish welding with cut lengths of Inco-Weld "A" filler wire (inert gas). In *both* jobs, the welds are sound, strong and as corrosion-resisting as the most corrosion-resisting parent metal.

Would these procedures and materials have succeeded with other dissimilar alloy combinations?

In most cases . . . yes! Inco-Weld "A" (electrode or wire) gives a high-quality weld in 97% of all dissimilar alloy combinations. Only rarely is a pre-heat or post-heat necessary.

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LIBRARY OF WELDING

continued from page 24

Titanium Welding

American Welding Society, Department T, 33 West 39th Street, New York 13, N. Y.; $1.50

The best methods for welding titanium piping and tubing by the inert gas tungsten-arc process are explained in a 24-page report published by the American Welding Society. A complete explanation is given of the welding process and the selection of electrodes and filler metals.

Many people and many companies contributed to the report. Information obtained from current welding literature, company files, research laboratories and colleges was examined carefully by an AWS Committee and approved by acknowledged experts in the field.

The contents of the report include: process, power supply, electrodes and filler metals; titanium grades, joint design and preparation, cleaning; gas shielding, welding techniques; heat treatment; weld quality tests.

Aluminum Weldability

"Study of the Weldability of Aluminum Casting Alloys with 5086 Wrought Aluminum Alloy." M. S. Orysh and I. G. Betz, Frankford Arsenal, U.S. Army, September, 1958, 55 *pages. (Order PB* 151307 *from OTS, U.S. Department of Commerce, Washington* 25, *D.C.,* $1.50)

The properties of 5086 wrought aluminum alloy sheet make the material promising for use as skin for ballistic missiles. This study was conducted to determine the weldability of the alloy to selected cast aluminum alloys. Inert-gas-shielded metal-arc (tungsten electrode) welding was used.

The cast alloys Almag 35, A1-7% Mg and 214 were satisfactorily welded to the wrought alloys. The materials ranked in that order in ultimate joint strength when the casting was overmatched by the 5086 member, forcing failure in the casting. Gross porosity was encountered in the weld when castings of a A1-7% Mg-3% Zn alloy were welded to the 5086 sheet.

The study demonstrated that thin weldments, welded without a backing strip, are more apt to have poor joint strip efficiency because of lack of fusion.

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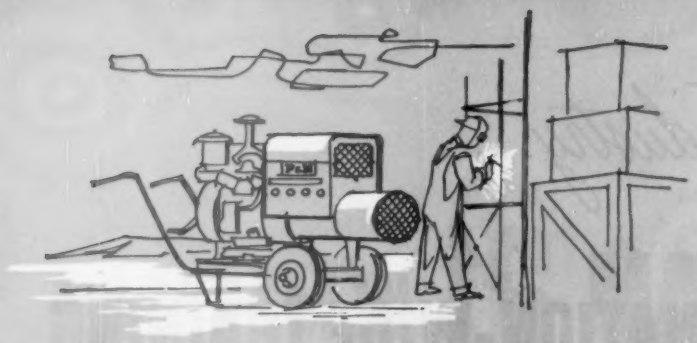
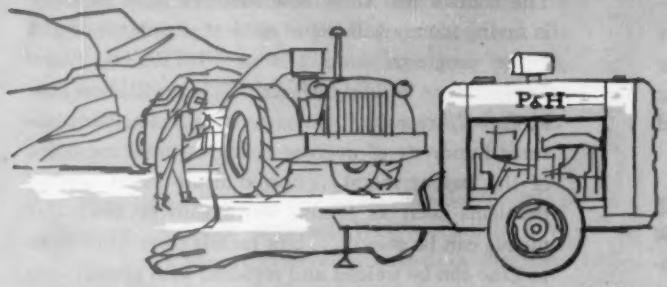
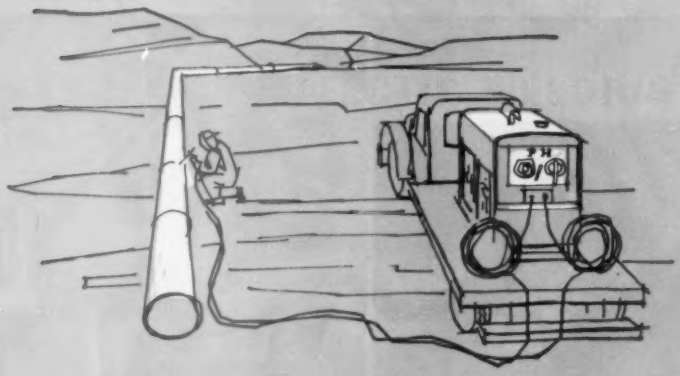


eliminate rewelds



and callbacks



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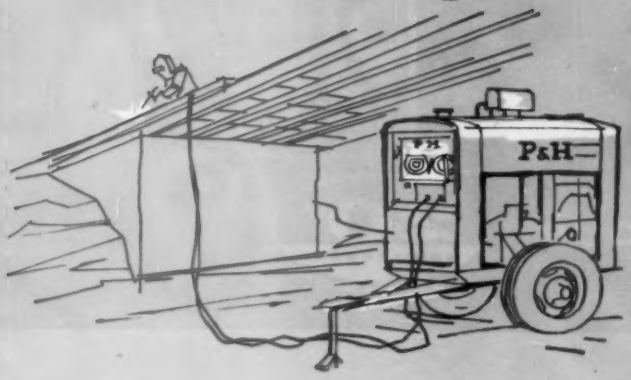
with P&H portable welders



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The courses will show how industry after industry is saving money with more efficient maintenance and repair programs using famous EUTECTIC "Low Temperature Welding Alloys"®. They will show how leakproof, strong joints can be obtained at temperatures hundreds of degrees below the melting point of the parent metal... how difficult metal joining problems such as joining extra thin or dissimilar metals can be solved... how metals from Aluminum to Zinc can be welded and repaired with greater ease and speed than ever before.

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week long Conference Courses. Each group will be limited to fifteen people to assure that everyone gets the fullest opportunity to profit from the latest advances in welding of heavy castings, tool and die repair, joining different metals and materials, general maintenance and repair problems and their job-proven solutions.

In preparing this, America's largest Weldor Training Program, Eutectic demonstration specialists have drawn upon the experiences acquired in the company's fifty years of research and development... upon its twenty-year background as a world-wide organization... upon the job knowledge acquired by its more than 350 specially trained technical representatives in the field. The well known Eutectic Welding Institute in Flushing, will provide guidance and organize these thorough courses.

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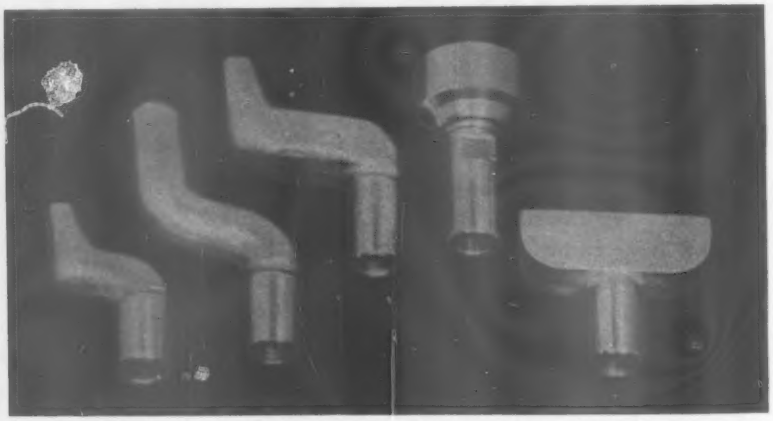

Acme Electric Welder Co., Los Angeles, a leading resistance welding equipment manufacturer, produces standard spot-welding tips from Chromium Copper-999 rod, seam-welding wheels from Chromium Copper-999 sheet. Irregular shaped tips, above, are Anaconda die-pressed forgings of Chromium Copper. In pieces fabricated from rod, bar, or sheet, strength and hardness are increased by cold working after heat treatment. Anaconda gives forgings an additional cold strike after hot forging to increase surface hardness. *Left:* A forged welding tip in an Acme water-cooled tip holder.

In resistance welding the electrodes must carry heavy currents under high pressures and at elevated temperatures. They must be made of materials that have high electrical and thermal conductivities and mechanical properties that will keep deformation and wear to a minimum. The widespread and growing use of resistance welding has stimulated research to meet the demand for more efficient and durable electrode materials.

CHROMIUM COPPER-999, one of Anaconda's high-strength, heat-treatable alloys, is an excellent electrode material with a record of superior performance in high-production welding. Electrical and mechanical properties exceed those listed for RWMA Class 2 material. Electrical conductivity is about 80% IACS and thermal conductivity is comparably high. In addition it has tensile strength of about 70,000 psi after heat treatment (compared with 48,000 psi for hard drawn ETP Copper), and its mechanical properties remain high at temperatures approaching 400 C. Available as rod, bar, sheet, tube and die-pressed forgings.

Anaconda also offers Hitenso®-961 as a more economical electrode material for use where service conditions are not severe enough to require the higher properties of Chromium Copper-999. Its properties exceed those of RWMA Class 1 material, having electrical conductivity of about 85% and tensile strength of about 60,000 psi. Available as rod, bar and plate.

TECHNICAL ASSISTANCE. For further information on these Anaconda alloys or for technical assistance in the selection of the right alloy to meet special problems, see your American Brass Company representative. Or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5983

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FEBRUARY, 1960
Welding Design & Fabrication
ESTABLISHED IN 1930 AS INDUSTRY & WELDING

An interview with W. A. Waidelich, vice president for engineering and research, The Austin Company, Cleveland, in which he tells . . .

Why We Design Welded Buildings

THERE ARE many advantages to welding bridges and buildings. But, in numerous organizations, welded design has taken a back seat as compared to riveted and bolted construction.

This is hard to understand, especially since pressure vessels, storage tanks, machine bases, and other heavy equipment have been welded for years.

Why, we wondered, are many structural designers so slow in picking up the advantage of welding? Some reasons we knew—resistance to change, mistrust due to incidents of careless welding, and failures blamed on welding (most of them traced later to other causes). But we wanted to go deeper than this. We wanted answers from an authority, someone actually working in the field, someone who knew the ground rules, obstacles, and trends.

We got these answers from A. T. Waidelich, vice president for engineering and research, The Austin Company, Cleveland. Here's what we learned:

When we think of The Austin Company, we think of welding. How did you get started with welded design?

Our business is designing, fabricating, and constructing industrial buildings. It was natural for us to be one of the first in our field to investigate welded design. In 1925, we experimented with welding on trusses. These were an ideal starter because our company had used a standard riveted design for ten years. We made destructive tests on riveted and welded trusses of the same basic design and found the welded one stronger.

Welding greatly simplified the design and detail of trusses. In many cases we could dispense with gussets. Because members were lighter and stiffer we could erect them easier and faster and the structure looks cleaner. Besides is was easy to make additions and alterations.

Why are structural field connections bolted instead of being welded?

In 1929 we erected an all-welded, 4-story building at our own expense to learn more about welded design. We welded all joints, including field connections. The job was wholly satisfactory, but it took weeks to erect the 117 tons of steel. We learned, once and for all . . . never to build another building without using temporary bolting (or equal) for field connections.

While field welding is used for the permanent connections on numerous buildings, todays' improved high strength bolting techniques are equally satisfactory for most structures . . . and often cost less.

Has one successful welded structure ever helped to sell another?

Yes. In 1935 when we were designing the big diesel locomotive plant at LaGrange, outside Chicago, executives of GMC's Electro-Motive Division expressed misgivings when we suggested welding the 2,600 tons of structural steel in that project. Then we learned

continued on next page

"Because welded members were lighter and stiffer we could erect them easier and faster."

that instead of using castings for the frames of their steamlined locomotives, they wanted to weld them, but were running into opposition from railroad executives who worried about safety. After we pointed out that there could be no more conclusive demonstration of weld integrity than an all-welded building that supported a 200-ton-traveling-crane with a total loading of 405 tons, they decided to weld the building and sold the railroads on welded underframes in the process.

At that time, the City of Chicago did not have code provisions for welding. However, in 1936, when Republic Steel asked Austin to weld the framework for the big new wire mill which they were starting inside the city limits, Chicago amended its code on the strength of what we had done at Electro-Motive.

Has welding facilitated any important changes in Austin's basic structural designs?

Yes. A good example of this was the truss we developed in 1944. Instead of splitting beams to make top and bottom chords, as we had done, we used standard rolled H-sections.

We could build the new truss to suit different loadings merely by varying the weight of the H-beams used for top and bottom chords. The center-to-center dimensions, truss depth, and drawing details remained the same. Another advantage of this design: The bottom chord of the truss could be used as a monorail.

The truss was easy to fabricate with welding. The same jigs were used for all truss weights. We cut the H's to length, tacked them in a jig, and set the assembly upright for downhand welding.

Another one: Back in 1936, we pioneered welded rigid frame arch and sawtooth designs made from H-beams. In recent years these designs have been widely accepted.

What are the obstacles to structural welding for buildings?

Initially our biggest obstacle was city codes. Many cities required special permission for each project and this resulted in time-consuming procedures to obtain building permits.

This no longer is a serious problem—most of the larger cities now have revised their codes to include welding or have simplified procedures for securing permits for welded structures.

However, in the northern section of the county we often have restrictions on the minimum temperature at which field welding can be done. This can be an obstacle to the field welding of structures when this work will have to be done in the winter months.

What convinced your structural designers that welding was dependable?

They had to be shown that welds did not fail . . . that they cost less . . . that fabrication and erection were easier and quicker. Our tests helped. We showed them that welded trusses were stronger than riveted. We gave them stronger, simpler designs that were possible only with welding.

When you switched to welded design, did you have to re-educate your designers?

Very little. They simply had to learn to use welding details instead of riveting details. Its as easy to make strength calculations for welding as for riveting. The transition to welded fabrication was gradual. The first welded trusses were the old riveted designs without the holes.

"What better way to demonstrate weld integrity than to point to a welded building that supports a 200-ton crane."

How hard is it for structural steel designers to switch from rivets and bolts to welding?

Not hard, but it depends on the designer. The younger men don't always change over easier than the old timers. What counts is mental age.

Who makes the choice between riveting and welding?

Usually the chief engineer. There are reasons when one or the other process is selected. The designer follows the decision.

What references do structural designers use?

Except as restricted by local codes, most welding conforms to the American Welding Society specifications. For the structural engineers the common handbook is the one issued by The American Institute of Steel Construction and this incorporates the structural specifications of the American Welding Society as well as other designing and detailing information for welding.

Are designers interested in the latest in materials, methods, and processes for welding?

Of course. But they haven't a very broad choice of structural materials. ASTM A-7 steel is standard for most buildings.

The designer is interested in processes that help him make the fabrication of his design practical. He must, for example, provide access for making connections. This is just as true for welding as riveting—but the requirements are different.

The shop, rather than the designer, is most concerned with methods. The shop must keep up with the latest in welding. They choose the process—manual or automatic—that will cost the least for the job.

Do designers exchange information and ideas on welded design?

Sure. The structural design leader keeps up on developments. He passes new and useful information on to his men. Most designers belong to technical societies and read the industrial press to keep informed.

Anything we use in structural design we use because it standardizes, reduces costs, or speeds fabrication and erection.

"Welding design will increase with better communications and more widespread education."

Will you compare the volume of welded structures with riveted and bolted construction?

That's a tough question. Works Manager Loren Miller of our Fabricating Division tells me that welded design has a slight advantage in volume over the other two processes. The number of welded structures are increasing, he says, but slowly. Rivet and bolt people haven't been idle. They're making bolting and riveting faster and more efficient, and they're selling hard.

But welded design has too many advantages to take second place. For one thing, welding suits the trend in architecture. Architects want function and beauty. They want you to see and feel the smooth flow of stresses.

What must be done to speed the adoption of structural welding?

Welding design will increase with better communications and more widespread education. Student engineers have to be taught the advantages of welded design.

". . . welding suits the trend in architecture. They want you to see and feel the smooth flow of stresses."

The welded structures already built advertise the advantages of welding. Each one makes the choice of welding a little easier and a little quicker. Not all of these structures were perfect; but each played a part in the development and progress of welded design.

We used to read about welding ships cracking up. Was that the end of welded ships? Far from it. You couldn't get designers to rivet ships now.

With the wide-spread acceptance of welding, whether shop fabrication and field connections are welded, riveted or bolted, it is primarily a matter of economics. Because it generally costs more, riveting is now used far less than it was ten years ago. In the shop, riveting has been widely replaced by welding; but in the field, high strength bolting has gained wide acceptance. Probably the future for both methods will depend upon developments still to come which will affect their relative costs.

A. T. WAIDELICH, The Austin Company's vice-president for engineering and research, joined this international engineering and construction firm in 1936 as a structural engineer in its New York district. There he had a hand in adapting Austin's pioneering welded rigid frame designs to some of the first American plants to use this technique. He was responsible for working out complex problems in the development of a 14-story core of welded steel bins for the coffee processing plant then under construction for Hills Brothers Coffee, Inc.

In 1941, Waidelich was assigned to research work and transferred to the company's headquarters in Cleveland. In this assignment, he played a leading role in the development and adoption of Austin's H-section welded truss designs.

As manager since 1949 of Austin's research division, which guides engineering surveys and reports, plant location surveys, etc., in all parts of the country, Waidelich has been responsible for the development of special techniques for evaluating the relative merits of different locations, layouts and materials handling methods which appear to be best suited for the solution of immediate and long-range problems.

A native of Philadelphia, Waidelich was graduated from Drexel Institute of Technology (BS-CE), and subsequently received his Master's Degree at Massachusetts Institute of Technology.

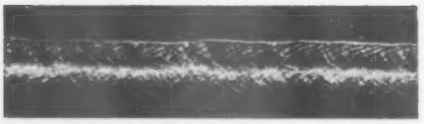
He taught structural engineering at M.I.T. and was as assistant professor of civil engineering at Roberts College in Istanbul before joining Austin. He was elected director of the company in January, 1959, when he assumed his present post.

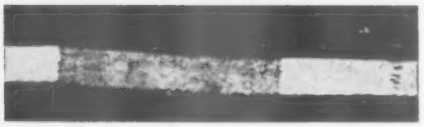
He is a member of the American Society of Civil Engineers, the National Society of Professional Engineers, the American Welding Society, Tau Beta Pi, and practices as a professional engineer in 38 states.

this machine welds . . .

LOW AMPERAGE vacuum tube arc welding machine operates on 115 volts, 60 cycle single phase with 15 amperes to provide a welding arc of 1/10 to 10 amperes.

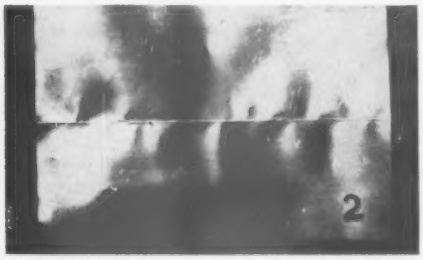
from .009 thick . . .

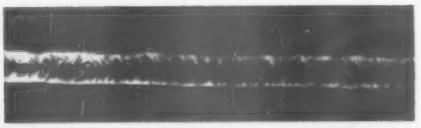




.009-INCH THICK full hard stainless butt weld: nine-inch section of weld (left); portion of weld magnified 8-times (right, top) and cross section through weld magnified 40-times (right, bottom).

. . . to .002 thin





.002-INCH THICK full hard stainless butt weld: nine-inch section of weld (left); portion of weld magnified 8-times (right, top) and cross section through weld magnified 50-times (right, bottom).

Convair Butt Welds .002-Inch Stainless

by W. P. McGREGOR, *tool development engineer, Convair-Astronautics Division of General Dynamics Corp.*

IN BRIEF: The trend toward using thinner gage materials in missiles shows that missile manufacturers soon will have to make fusion butt welds in metals as thin as .001-inch and thinner.

WITH THE INCREASING DEMAND for butt welding of thin stainless steels and other materials, the need for an extremely low amperage arc welding machine has become more critical.

Several methods of butt welding have been tried with varying degrees of success. Some manufacturers have modified existing equipment by adding resistors in the circuit for lower welding currents. Increasing the welding speed so a greater current can be used has also been tried. To some extent, this gets the job done.

Some commercial welding power sources provide as little as one-half ampere. These machines have to be coaxed to strike the arc at less than about five amperes. They can go as low as one ampere and maintain the arc once it is established. The type of welding power source needed for welding thin materials (.010-to .001-inch) is one in which the arc will actuate consistently at low amperages and continue through a relatively wide arc voltage range.

To meet the challenge of welding the thinner-than-paper materials, our manufacturing development personnel discussed the need for an extremely low amperage welding machine with possible manufacturing sources. One manufacturer agreed to make a special machine to our specifications: A 1/10 to 10 ampere

continued on page 45

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Preheating carbon-moly tubing with Victor Model J27 torch and Type 28 heating nozzle at Besler Corp., Emeryville, Calif.

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Flexibility is built into all Victor torches, regardless of size. Here, for example, Series J torches are being used to preheat, then weld ⅝" O.D. with .095" wall tubing for steam generators. With a change of nozzles and tips these same torches braze and solder . . . with the addition of a cutting attachment, can be used for light cutting applications and ocasional short jobs up to approximately 2" steel.

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Welding ⅝" O.D. with .095" wall tube into generator coil, using Model J27 torch and Type 17 welding nozzle with oxy-acetylene.

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WHY WAIT? Check the unusual welding properties of this new, *better* manganese electrode today! Compare it with every other manganese electrode you've *ever* used... you'll agree it's the best in the field! Your Stoody dealer will be glad to have you test it on your own job!

PHYSICAL PROPERTIES:

(Based on tests by independent laboratory)

	DC Straight Polarity	DC Reverse Polarity
Tensile Strength	119,000 psi	111,000 psi
Yield Strength	67,000 psi	66,000 psi
Elongation in 2"	55%	37.5%

Hardness—Single pass on manganese steel; as deposited—15 Rc, as work-hardened—48 Rc.

Two passes on manganese steel; as deposited—18 Rc, as work-hardened—48 Rc.

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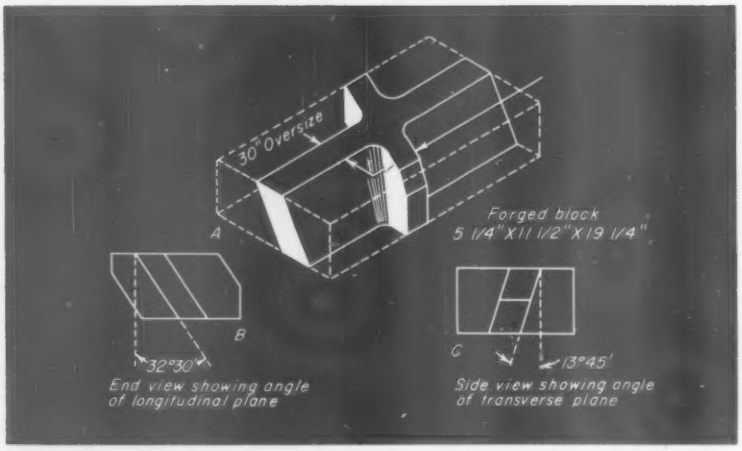


FIGURE 1: The basic problem was to produce a smooth, flame cut part with parallel surfaces. The part had to meet tolerance of +0.30-inch to conform to the mock-up block.

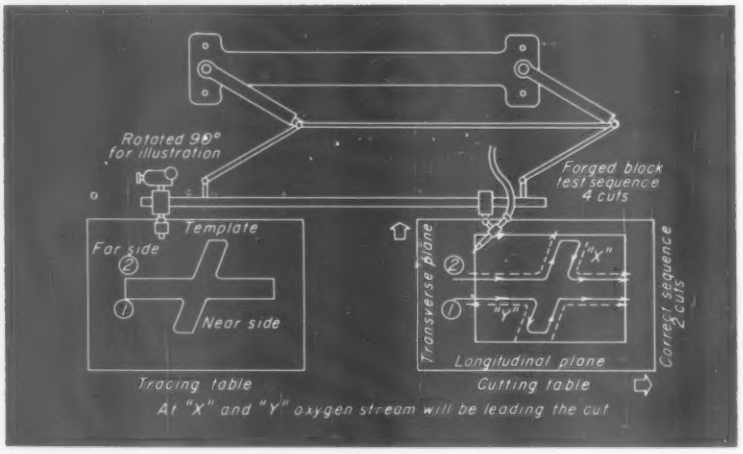


FIGURE 2: Four cuts were made from four different locations on the magnetic tracing template to determine proper cutting sequence for the most efficient application of the torch to the compound angularity of the work.

20 Times Faster... Flame Cutting Replaces Machining

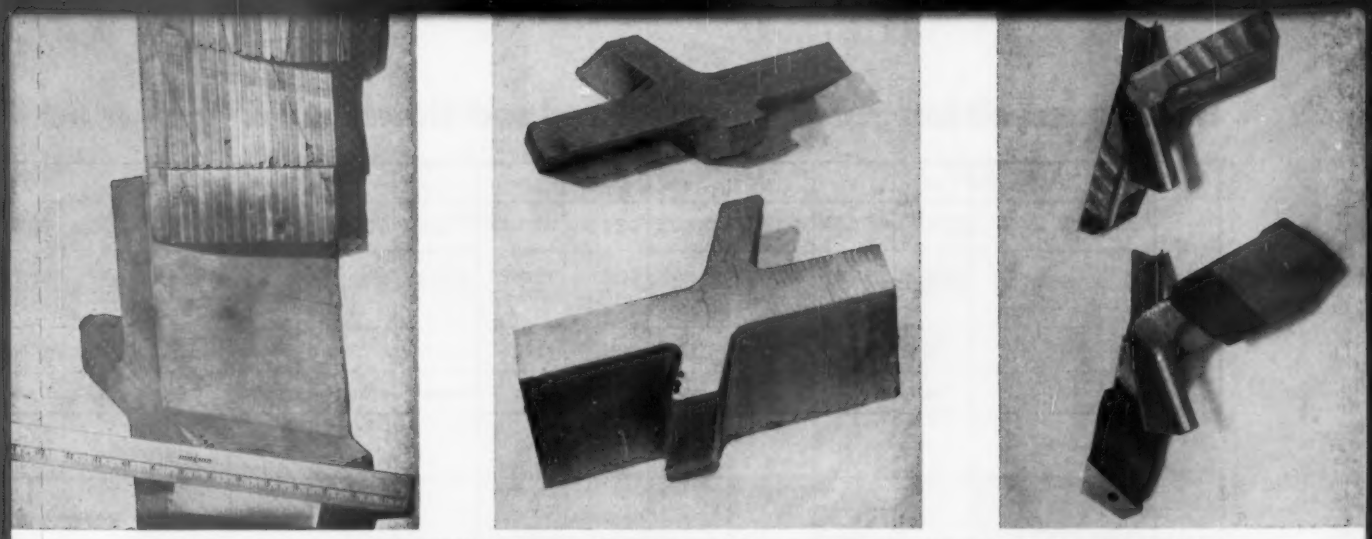
IN BRIEF: Flame cutting eliminates the costly removal of excess metals by drilling, milling and bandsawing.

BOEING AIRPLANE COMPANY of Seattle, Washington, wanted to find out if existing mechanized oxyacetylene flame cutting equipment could be used more widely for production cutting of aircraft detail parts from mild and SAE 4340 low alloy, high tensile steel. Why? Mechanized flame cutting severs steel about 20 times faster than drilling and bandsawing. It yields a greater variety of shapes and more accurate cutting. It reduces operator fatigue, costs less for labor and gives a greater depth of cut over longer duty cycles.

The basic problem was to eliminate the costly removing of excess material by drilling and bandsawing parts prior to final machining.

Tests were made to see if existing equipment was practical for use on production parts made of mild, medium carbon and 4340 molybdenum alloy steels. Tests were also made to investigate the metallurgical effects of flame cutting in the hardened zone adjacent to the heat-affected area of the flame cut face and to determine allowable tolerances.

As a result of these tests, a Manufacturing Research Report issued by a Boeing Planning and Design Unit recommended that flame cutting be used to replace band sawing, milling and drilling operations wherever possible when roughing out detail parts from steel ⅛- to 10-inches thick.



WINDOW FRAME CONFIGURATION is shown in three stages. It is flame cut to mock-up dimensions (left), ready for milling and machining (center) and completed after machining (right).

The report further indicated that flame cutting can be used where parts must be cut within 0.125-inches of machining requirements. However, it was recommended that part try-outs be used on special, intricate parts. On such parts care is taken to make sure the heat affected area of the material is removed in the machining operations.

MATERIAL AND TEST EQUIPMENT

Materials tested included a forged block of SAE 4340 (5¾- by 11½- by 19¼-inches), SAE 4340 plate (⅝-, 2- and 3½-inches thick) and ¼-, ½-, 1-, 2- and 3-inch commercial quality open hearth steel (0.15 to 0.25 percent carbon).

Three types of mechanized flame cutting equipment used by Boeing were tested. These included a multiple-torch shape-cutting machine with four torch capacity (Airco No. 6A Oxygraph); a single torch, straight line and circle cutting machine (Airco No. 10 Radiagraph) and a single torch shape cutting machine (Heath Engineering Company's Ultragraph which is comparable to Airco's Camograph).

Accessories used included medium-pressure single-stage oxygen and acetylene regulators for preheat control; a heavy-duty two stage, high pressure oxygen regulator for cutting oxygen control and configuration templates for a typical windshield fitting.

TEST PROCEDURES

A functional test was made to determine if existing facilities could be used to mechanically flame cut the mock-up block of the typical windshield fittings. The basic problem was to produce a smooth part with parallel surfaces. The part had to meet tolerances of +0.30 inch to conform to the mock-up block (Figure 1a).

A rejected 4340 forged steel block (5¾- by 11½- by 19¼-inches) was used. The necessary template, cutting-tip pointer and angular V-block for torch-tip alignment of compounded angles were obtained along with flame cutting equipment and an operator.

The forged bar was preheated in a furnace for seven hours to about 700°F—one hour for every inch of thickness. (High carbon or alloy steels are preheated to eliminated "upsetting" and the possibility of edge cracking.) Following preheating, the forged block was set up on the cutting table.

The flame cutting was done as quickly as possible to prevent preheat temperature drop. A cutting tip with heavy preheat holes was used (Airco-style No. 164, size number 7). This gave a good washing action in the kerf. It produced a smooth face on the heavy beveled lines of cut.

Four cuts were made from four different locations on the magnetic tracing template to determine proper cutting sequence for the most efficient application of the torch to the compound angularity of the work (Figure 2).

The cutting operations were as follows:

First, parts were preheated (600 to 900°F). Enough furnace soaking time was allowed so preheat temperature soaked into the core or middle of the forged block.

text continues on page 42

COST COMPARISON shows difference between cost of flame cutting and band sawing and milling of windshield fittings.

FLAME CUTTING		BAND SAW & MILL	
• LOAD & REMOVE ROUGH BLOCK FROM PRE-HEAT FURNACE*	68	• DRILL "STARTER" HOLES	934
• FLAME CUT TO SIZE	297	• LAYOUT ROUGH TRIM DIMENSIONS FROM TEMPLATE	—
• ADDITIONAL GRIND HANDLING TIME	77	• BANDSAW TO ROUGH TRIM DIMENSIONS	2268
		• MILL TO SIZE COMPARABLE TO FLAME CUT DIMENSIONS	2170
TOTAL MAN MINS/PART	442	TOTAL MAN MINS/PART	5372
TOTAL MAN HOURS/PART	74	TOTAL MAN HOURS/PART	8.95
TOTAL SAVINGS = 8.21 MAN HOURS PER PART			

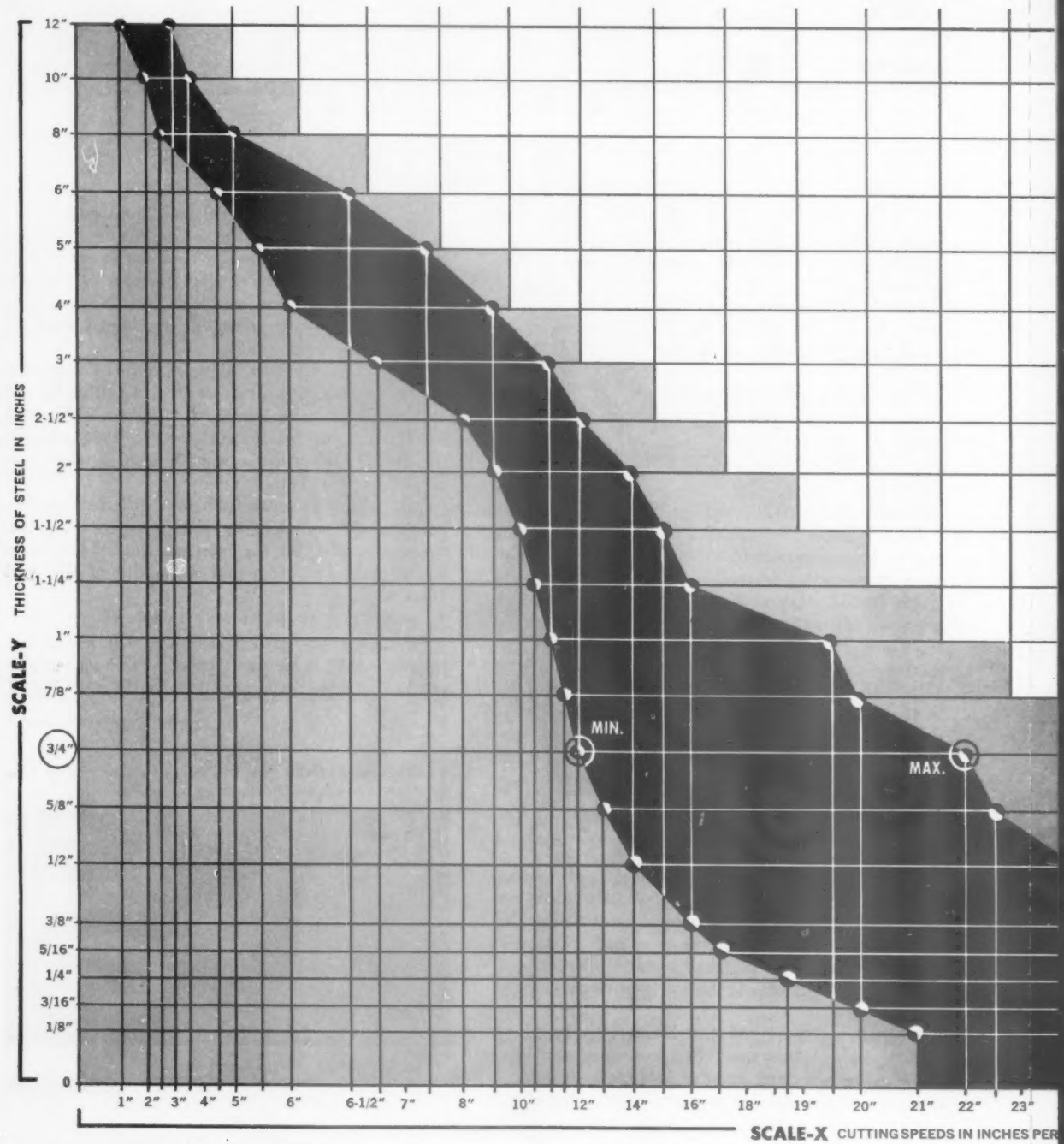
*Does not include furnace heat time.

**Only non-identical operations are listed; all other operations are identical and do not affect this analysis.

Boeing uses this guide for mechanized flame cutting of mild, l

TABLE "A"

12"					10"	8"	6"	5"	4"	3"	2-1/2"	2"	1-1/2"	1-1/4"	1"	7/8
1/8	31	30	30	28	36 31 35 30 28	36 39 35 35 35	42 39 43 42 40	42 39 43 42 40	47 46 50 42 45	47 46 50 46 45	50 46 50 51 50	53 46 50 51 50	53 53 55 53 52	55 53 55 53 52	55 53 55 53 52	55 53 55
.125	.120	.129	.129	.141	.1065 .120 .110 .129 .141	.1065 .0995 .110 .110 .110	.0935 .0995 .0890 .0935 .0980	.0935 .0995 .0890 .0935 .0980	.0785 .0810 .0700 .0935 .0820	.0785 .0810 .0700 .0810 .0820	.0700 .0810 .0700 .0670 .0700	.0595 .0810 .0700 .0670 .0700	.0595 .0595 .0520 .0595 .0635	.0520 .0595 .0520 .0595 .0635	.0520 .0595 .0250 .0595 .0635	.0520 .0595
29					36	36	42	42	48	48	50	50	53	55	55	57
1160					1065	1065	0935	0935	0760	0760	0700	0700	0595	0520	0520	043

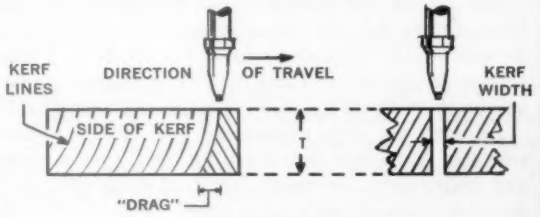


...y alloy-high tensile and carbon steels not over .40 carbon...

(3/4")	5/8"	1/2"	3/8"	5/16"	1/4"	3/16"	1/8"	MATERIAL THICKNESS
55 53 55 56 52	57 60 60 56 54	57 60 60 56 54	57 68 60 62 58	64 68 68 62 58	64 68 68 62 65	64 72 68 62 65	69 76 68 68 72	DRILL SIZE
.0520 .0595 .0520 .0465 .0635	.0430 .0400 .0400 .0465 .0550	.0430 .0400 .0400 .0465 .0550	.0430 .0310 .0400 .0380 .0420	.0360 .0310 .0310 .0380 .0420	.0360 .0310 .0310 .0380 .0350	.0360 .0200 .0310 .0380 .0350	.0292 .0200 .0310 .0310 .0240	CUTTING ORIFICE IN DECIMALS
57	61	61	65	65	65	69	69	TIP SIZE FOR ACETOGEN GAS
0430	0390	0390	0350	0350	0350	0292	0292	

PERMISSIBLE "DRAG"

THE "DRAG" OF A CUT IS THE DISTANCE THE "KERF" LINES AT THE BOTTOM OF THE CUT LAG BEHIND THE LINES AT THE TOP. THE MAXIMUM PERMISSIBLE "DRAG" IS THAT WHICH LEAVES NO UNDERCUT CORNER, OR NO CORNER UNCUT AT THE FINISH.



$$\frac{\text{"DRAG" IN INCHES}}{\text{"T" IN INCHES}} \times 100 = \text{\% "DRAG"}$$

IF PLATE THICKNESS IS 2" AND THE AMOUNT OF "DRAG" IS 7/32" THE CALCULATED DRAG IS: $\frac{7/32"}{2}$ X 100 10.935 OR 11%

(NOTE: SEE TABLE "C" FOR APPROXIMATE MAXIMUM PERMISSIBLE "DRAG") FOR MATERIAL THICKNESS

TABLE "C"

"DRAG" GUIDE TABLE

THICKNESS OF STEEL IN INCHES	APPROX. LENGTH OF "DRAG" IN INCHES
1/2"	NOT OVER 3/32"
1"	NOT OVER 3/16"
2"	NOT OVER 7/32"
OVER 2"	1/4"

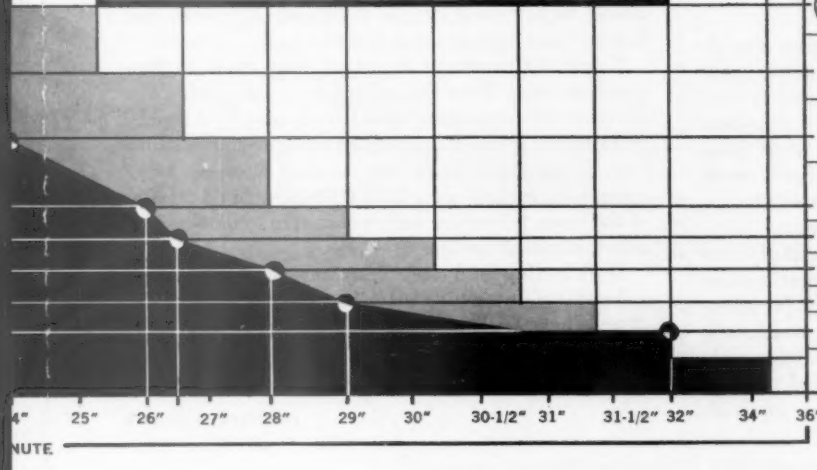


TABLE "B"

THICKNESS OF STEEL IN INCHES	RECOMMENDED GAS PRESSURE REGULATOR SETTINGS				APPROXIMATE CUTTING KERF WIDTH IN INCHES
	OXYGEN ACETYLENE		OXYGEN ACETOGEN		
	CUTTING OXYGEN PRESSURE LBS. PER SQ. IN	ACETYLENE PRESSURE LBS. PER SQ. IN.	CUTTING OXYGEN PRESSURE LBS. PER SQ. IN.	ACETOGEN PRESSURE LBS. PER SQ. IN.	
12"	60-90	8-12	70-90	8-10	.265
10"	55-85	8-12	70-90	8-10	.250
8"	50-80	6-10	65-85	8-10	.230
6"	35-70	6-9	50-70	6-8	.210
5"	45-70	5-8	50-70	6-8	.190
4"	40-65	5-8	50-65	6-8	.160
3"	35-55	4-7	50-65	6-8	.160
2-1/2"	35-55	4-7	45-65	5-7	.145
2"	30-55	4-7	40-65	5-7	.125
1-1/2"	25-50	3-6	40-65	5-7	.125
1-1/4"	35-55	3-6	35-60	4-6	.125
1"	25-50	3-6	35-60	4-6	.120
7/8"	30-50	3-6	35-50	4-6	.120
(3/4")	20-45	3-5	35-50	4-6	.120
5/8"	15-45	3-5	30-50	4-6	.085
1/2"	15-40	3-5	30-50	4-6	.085
3/8"	10-35	3-5	20-35	3-5	.085
5/16"	10-30	3-5	20-35	3-5	.075
1/4"	10-30	3-5	20-35	3-5	.075
3/16"	10-30	3-5	15-30	3-5	.050
1/8"	10-30	2-5	15-30	3-5	.050

TABLE "B"

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METALS PREHEAT TABLE		
MATERIAL	CARBON	PREHEAT TEMPERATURE
Plain carbon steel	Below 0.20%	200°F to 250°F
Lower preheat range for	0.20 to 0.30%	250°F to 350°F
the lower carbon range	0.30 to 0.40%	350°F to 700°F
Low alloy high-tensile steels, Nickel Silicon Manganese structural steels, and heat-treatable steels.		600°F to 900°F

PREHEATING GUIDE is followed to prevent "upsetting" and eliminate possibility of edge cracking.

FLAME CUTTING *continued from page 39*

Second, the forged block was placed with the longitudinal sides parallel to the longitudinal sides of the multiple torch shape cutting table (Figure 2).

Third, starting from the left-hand side and traveling to the right along with longitudinal plane of the forged block, only two cuts were necessary (Fig. 2).

Fourth, the first cut was made from the near side of location point number 1 on the tracing templates. This sequence allowed the cutting oxygen stream to establish the necessary 32° 30′ angle along the longitudinal plane of travel. It also allowed the necessary 13° 45′ angle along the transverse plane of travel. (Figure 1b and 1c).

Finally, the second cut was started from the far side at location point number 2 on the tracing template to produce the back side of the beveled configuration (Figure 2).

This sequence allows the established oxygen stream or jet to drag three quarters of the total cut rather than lead into the cut. Leading into the cut can cause excessive gouging. The only time this sequence is changed is when the forged block lacks enough material edge margin the start the cut.

After the cut had been completed, the part was allowed to cool to room temperature; then it was post-heated to 1250°F for three hours and allowed to cool in the furnace or still air. This is the new post-heat treatment cycle. Immediate heat treatment after flame cutting was found to be causing increased hardness of the flame cut face. At no time is the part subjected to more than 1250°F during post-heat treatment.

From the test on this windshield fitting, trial production runs were started on windshield configurations for the KC-135 jet transport-tankers and the 707 jet transports. (These were flame cut from solid metal. It's much cheaper than rough machining them from solid, metal blocks. Later, when design was settled, it paid to make forging dies. This is by no means unusual. Other parts made in this manner include the rocket boost fitting for the Bomarc supersonic interceptor defense missile, the release latch for the B-52, hinge fittings for the KC-135 and the 707 and landing gear universals and nuts for the C-97 military transport.)

All parts cut were satisfactory and showed a considerable increase in actual cutting speed over saw-cut and drilled parts. Seventeen flame cut parts were produced in approximately seven hours. Only one drilled and saw-cut part had been turned out in six and one-half hours.

Further tests were made on ⅝-, 2- and 3½-inch thick 4340 steel to determine heat-affected area, squareness of cut, width of kerf and sharpness of edges.

Tests on single mild steel plates were made to evaluate the feasibility of extending mechanized flame cutting to current production. A straight line cutting machine was used for straight-line, single-plate thickness cuts and stacked cuts. A single torch shape cutting machine was used for single-plate and stacked-plate shape cuts.

A tracing template was made to simulate inside and outside sharp corner cuts. Tests were made on ½-inch mild steel, using a No. 61 Acetogen tip and approximately 45 pounds of oxygen to six pounds of acetogen. Cutting time was about 9 minutes and 35 seconds.

Twenty-six shape cut test plates were made at three locations using three Camograph-type machines. Close tolerance measurements varied from zero to 0.10-inch in an accuracy check against the three machines. However, in repetitive flame cuts on each machine, tolerances were maintained within 0.06-inch. In 65 percent of the cases, tolerances were within zero to 0.04-inch of drawing measurements.

Stack cutting mild steel: Tests were made with shape and straight-line cutting machines. Eight ¼-inch plates of open hearth, plain carbon steel were stacked to make a total thickness slightly over two inches. Plates were clamped together by strongbacks and heavy C-clamps.

continued on page 44

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FLAME CUTTING *continued from page 42*

Cutting oxygen pressure was 50 pounds and Acetogen pressure was seven lbs. for a No. 50 Acetogen tip. Cutting speed was approximately 4¾ ipm. At the same oxy-acetogen pressure settings, a straight-line cut was made at about 6½ipm.

TEST RESULTS

SAE 4340 alloy steel: A photomicrograph of the flame cut surface of the 4340 steel shows a thin white line about zero to 0.009-inches thick. The thin hard layer adjacent to the heat-affected zone of the flame cut face is due to a definite metallurgical grain structure and chemical analysis.

Chemical analysis of the flame cut face without preheat indicated a carbon content of about 1.03 percent and nickel of 8.5 percent. (This change takes place in the previously mentioned thin white line.) The chrome and manganese appear to have been volatilized.

Chemical analysis of the flame cut face cut with preheating indicates the same effects, except for carbon which has not yet been analyzed.

Regardless of the fuel gas used, this thin hard layer appeared on the face of flame cut 4340 steel.

Microhardness surveys of flame cut surface indicated the best treatment for producing machinability of the cut face. This was preheat, 600°F air-cooled to room temperature, temper 1250°F for 3 hours, Rockwell C38.

Magnetic flux inspection indicated that no checks or cracks were present in any of the test specimens on 4340 steel.

Mild steel: Oxy-acetylene flame cut surfaces on plain carbon open hearth (mild) steel show a Rockwell hardness below 20C.

Tests on stack cutting showed that a single torch machine cannot be used in all cases. The quality, reliability and economy of each application must be determined by the analysis, thickness and condition of the material, the tolerances allowed and the size and shape of the part.

If proper clamping cannot be maintained, tests showed that spoilage will generally occur.

Both 4340 and mild steel: Tests on plates thicker than ⅝-inch and not preheated showed the maximum bevel from the perpendicular should be no more than 55°. Bevels belond 55° caused considerable oxygen stream turbulence and deep grooving of the cut face.

Preheating prior to flame cutting made starting easier and improved the smoothness of the beveled flame cut face.

Tests showed the heat-affected area on bevel cuts indicated a greater change at the bottom or pointed edge of the bevel than at the top.

Flame cut tests showed the sharp outside and inside corners are more susceptible to heat affect. This heat affect is deeper than when making simple straight cuts.

Tests on the degree of precision obtained showed that squareness of the cut face will be altered about 0.010-inches from top to bottom when proper techniques are used. However, dirty cutting tips can change the cut face squareness as much as 0.060-inch. ••

.002-INCH STAINLESS *continued from page 34*

machine with an arc actuating at any amperage within the range. That company designed and built the machine in cooperation with our personnel.

DESCRIPTION

Determining the electronic components necessary to meet the specified requirements took weeks of planning and experimenting. One of the unique features of the machine: Rectification and high frequency oscillation is done with a vacuum tube. The machine was developed and manufactured with two ranges: The high range is from one to ten amperes; the low range is from 1/10 to two amperes.

The machine's arc voltage is from 10 to 25. It is a self-contained power supply operating on 115 volts, 60 cycle, single phase, 15 amperes current.

TESTING AND CHECKING

During development and evaluation of this machine, our welding engineers periodically charted the unit's welding characteristics. Then they made recommendations for additions and changes to meet requirements.

In testing the unit, we found an arc from approximately 3/8-inch long could be maintained and could be varied many times that of conventional machines and still retain a relatively steady arc. The arc would actuate all ampere settings between 2/10 of an ampere and the maximum of ten.

An interesting phenomenon was observed at the lower amperage settings, especially at less than one. With no change in arc length the voltage increased. If the voltage at one or two amperes was 15, then reducing the amperage to 6/10, for example, increased the voltage to 25 while the arc gap remianed unchanged. The rate on the voltmeter (10 to 25 volts) was considered sufficient to cover the welding range. We called in electrical specialists to determine the cause of this phenomenon. They decided the cause was that the resistance across the arc gap increased as the current decreased due to the ionization characteristics of the gaseous substance in the arc gap.

DEVELOPMENT WORK

With a welding machine that performs exceptionally well at less than one ampere, one of the main problems in welding thin metals is conquered. We have maintained an arc on .0015-inch thick materials without burn-through. It seems this power source is capable of welding any thickness that can be rolled. We have welded materials .002-inch thick without encountering any arc troubles. However, still remaining are problems in material fit-up, tooling and other variables.

Some non-uniformity is present in welds, including a reduction in area in some cases. The thinner gages have cans and wrinkles along the weld. Tests are continuing so we can make the process reliable and reproducible on almost all gages. To date the work has been done on flat parts in straight line welding fixtures. Plans are progressing to make weld tests on contour parts using a voltage control head. These heads are designed to operate at above 20 amps; none are designed to operate at less than that.

Work is being done currently to adapt heads to work off the low amperage welder. • •

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How A Spot

by **JAMES K. DAWSON**
Special Assistant to the Director of Fabrication and Assembly Engineering Lab. A.B.M.A. Redstone Arsenal, Alabama

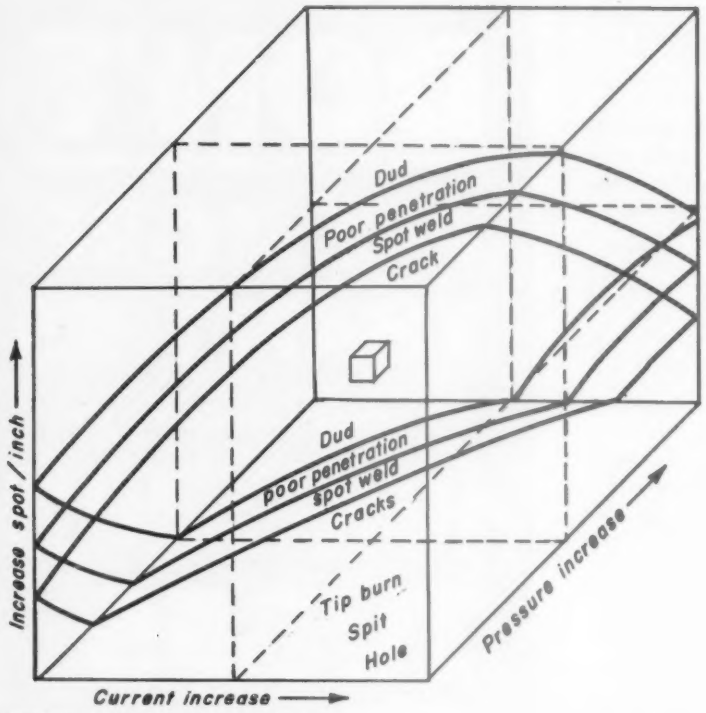

FIGURE 1: Spot welding variables

NOMENCLATURE

Tan θ is the slope of a straight line between X and Y
Tan ϕ is the slope of a straight line between Z and Y
Log refers to log to the base 10
L_n refers to natural logarithm
e^X refers to natural antilogarithm
10^{ex} refers to 10 base antilog of natural antilog

Circular—$P = L_n (e^x \tan\theta + e^x)$
Straight Line—$P = C + \tan \times I$
Log Curve—$P = CI^{\tan\theta}$
P = High or Low Pressure
C is Y intercept
Tanθ = slope of graphical plot
I = Current

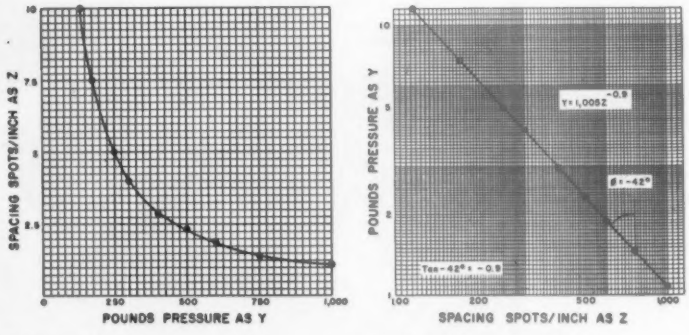

FIGURE 2A: Example of spacing vs. pressure for 5052 and 5086 Al

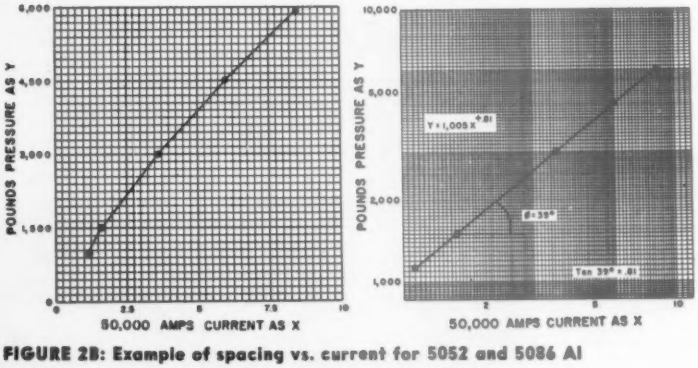

FIGURE 2B: Example of spacing vs. current for 5052 and 5086 Al

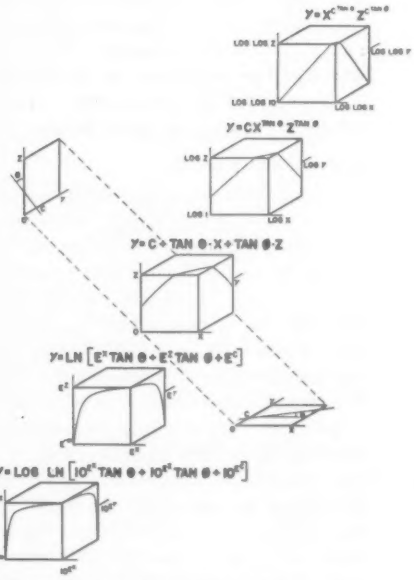

FIGURE 3: Mathematical block diagram

Weld Can Be Set Up Mathematically

IN BRIEF: Mathematical formulas developed by Army Ballistic Missile engineers help them predetermine spot welding variables. The author explains how they use these formulas to make better spot welds.

SPOT WELDING has come a long way at the Army Ballistic Missile Agency, Redstone Arsenal, Huntsville, Alabama.

The purpose of this article is to explain a formula of a family of curves they derived, and how they use them to predetermine variables in spot welding.

Figure 1 shows a drawing of a large cube, a small cube, and 3 groups of paralleled curved planes within and around these planes when pressure, current and other adjustments are made in setting up a spot weld. The large cubical space of the diagram is concerned with the overall heat or *current*, the interface resistance or *pressure* and the shunt effect or *spacing*. The smaller cubical space within these curved planes is the intricate final improvements made by controls such as preheat, postheat, pre-forge, current-decay and tip radius.

The mathematical blocks in Figure 3 show some possibilities for fitting formulas to curved surfaces in space diagrams. The center cube is very close to the type encountered in resistance welding. The paralleled planes are slightly warped and intersect the faces of the cube by curved lines.

Take for example current versus pressure as the X- and Y-axis, in the lower plane of the diagram, to the lower right of the zero corner of the center cube, it shows one intersection.

The good welds fall on the intersection line. Go off the line to either side and you get bad results. Go towards the upper left, towards Y or high pressure and low current and you get into the area where you get nothing but duds. If you stay pretty close to the line you get semiduds or partially formed welds with areas of low penetration and lack of bonding. The corona ring outside the weld zone (where cohesion has set up) will often mislead inspectors because its larger diameter has an equivalent-or-greater shear strength than a good weld. Its pitfall is that it has no fatigue or impact strength. If you go on the other side of this good-weld line, towards the X or high current and low pressure, you get welds with internal coring, cracks, and porosity. In other words, you have a narrow path to follow. From small spots with low

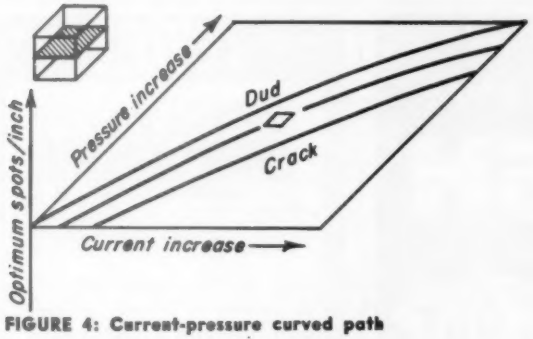

FIGURE 4: Current-pressure curved path

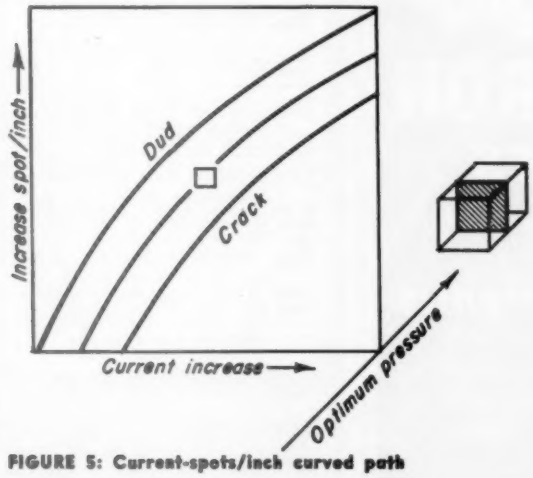

FIGURE 5: Current-spots/inch curved path

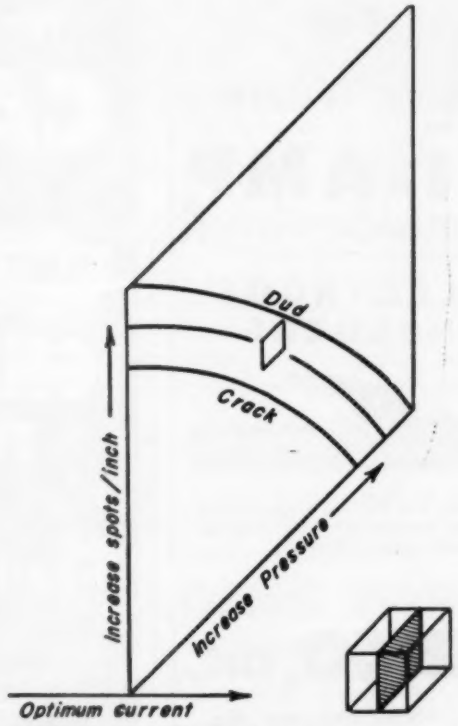

FIGURE 6: Pressure-spots/inch curved path

pressures and low current on up to large spots with high pressure and high current, the limits at both ends are set by the size and capabilities of the welding machine. You can see that an operator needs to adjust the pressure and current together to stay on the line. This is done when:

$$\text{Current} = C + \tan\partial \times \text{number of spots per inch:}$$

Spot spacing versus pressure, works the other way. (See graphs). As you increase the number of spots per inch, you must cut the pressure to make sound welds. Use too much pressure with an increase in spots per inch and you get duds just as you did for pressure versus current. The left face of the cube has this line of intercept running at an angle ϕ with the same Y intercept of C. Thus you should reason that placing spots closer together calls for less pressure as shown according to the formula:

$$\text{Pressure} = C + \tan\theta \times \text{number of spots per inch}$$

Now combine the first and last idea together to form a plane in the space diagram. The formula is

$$\text{Pressure} = C + \tan\theta \times I + \tan\theta \times \text{spacing as number of spots per inch}$$

Note: Y or the pressure is the function as $Y = C + \tan\theta \times X + \tan\phi \times Z$.

All this is fine except the surface is not flat. It is usually a curved surface. Transposing all information available to natural analog paper represented by e^x (in the diagram it is shown E^x), a spherical type curved surface would be flattened out and the angles and the intercept would yield:

$$\text{Pressure} = L_n \{e^{\text{Current}\tan\theta} + e^{\text{Spacing}\tan\phi} + e^C$$

The next step in this direction will straighten out a round cornered cube type surface by using 10^E raised to the X power. The data from most welding machines are much flatter surfaces than those above and can be flattened out by using log paper. Then the log formula becomes:

$$\text{Pressure} = C \cdot \text{Current}^{\tan\theta} \times \text{Spacing}^{\tan\phi}$$

The extreme of a progressing curve plane like an almost straight line with a spiral at one end can be handled by the advance equation

$$Y = X^{\text{ctan}\theta} \cdot Z^{\text{ctan}\phi}$$

or its equivalent in pressure, current and spots per inch.

The former seems to be generally the most satisfactory and is simple to use as Y is the dependent variable and C is the intercept of Y axis at the log 1 or zero of X and Z, and θ and ϕ are the angles with the X and Z axis when plotted by log paper. The answer is then:

$$Y = \{CX^{\tan\theta} \cdot Z^{\text{ctan}\phi}\}$$

Put current in for X and number of spots per inch in for Z and you get the pressure setting Y.

Those who prefer can use log paper, solve the problem in two parts. Figures 2a and 2b are good examples.

Remember the danger of changing the pressure by itself, or the current, or spacing. Remember the 3-dimensional relation. The three must work together to stay on the good-welding surface. • •

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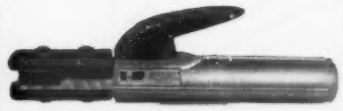

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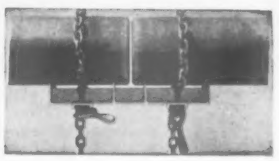

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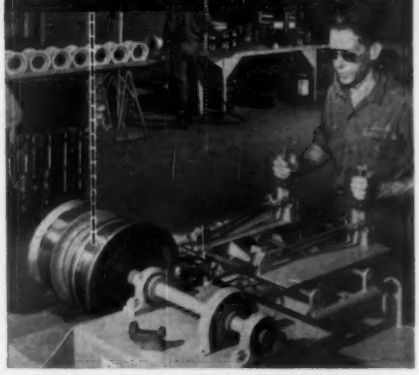
The flanges are then heated to 1500°F and immediately water-quenched, giving a non-spalling surface of about Rockwell C-55 and shading down to Rockwell C-40 at the base metal.

This build-up method is fast—and far less costly than the usual tubular alloys. It's also a good example of the versatility afforded by the wide selection of PAGE welding wires.



Flame hardening of flanges is done on this machine designed by Track Service Company. Top illustration shows cross-section of hardened flange.

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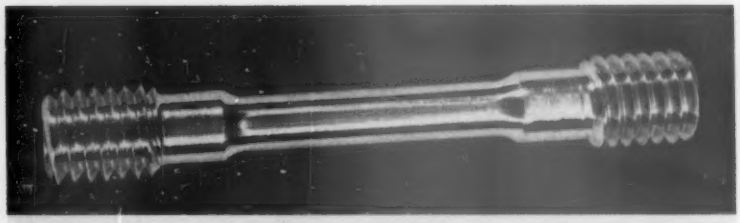
Rohr Develops Techniques For Welding New High-Strength Nickel-Base Alloy



TENSILE TEST RESULTS

Heat treated 1400F. ±15F. for 16 hrs.

Identification	Yield strength psi	Ult. strength psi	Fracture
R3-1	158,300	196,800	Edge of weld
R3-2	149,400	185,500	Edge of weld
R3-3	162,000	190,000	Parent metal
R3-4	159,100	188,500	Edge of weld
Heat treated 1650F. ±15F. for 4 hrs.			
R6-1	127,500	169,000	Edge of weld
R6-2	130,000	157,800	Edge of weld
R6-3	128,000	177,600	Edge of weld
R6-4	127,300	180,600	Edge of weld

WELD TESTS showed it was impossible to find weld after machining tensile test sample (top) and that strengths ran well over specifications (bottom).

WELDED CRUCIFORM was made without fixtures.

IN BRIEF: Tests on Rene 41 alloy show welds remain sound after stress has fractured parent metal.

ONE OF THE NEWEST METALS to appear in the aircraft and missile industry has been welded successfully at Rohr Aircraft Corp., Chula Vista, California. The metal is a nickel-base alloy known as Rene 41, or simply R-41. This new, vacuum-melted alloy was developed by General Electric Co. It is sold under license to the government by Haynes Stellite Co., Division of Union Carbide Corporation.

DESIGN BACKGROUND

Rene 41 has attracted intense interest because it has exceptionally high strength at temperatures ranging from 1200 to 1800°F.

Because it is strong and resists oxidation, the alloy was used initially in afterburner parts and nozzle diaphragm partitions in gas turbine engines.

Plans to use the alloy in structural components for high performance aircraft showed the need for more information on welding and fabricating. Experience with the previous jet engine parts did not provide Rohr all the information needed.

So, Rohr's Manufacturing Research and Engineering Departments ran literally hundreds of tests with the limited available supply of this critical alloy.

WELDING

Rohr had little difficulty in getting satisfactory welds when welding was done carefully. Both plate and sheet stock were welded in a wide variety of thicknesses and joint designs.

A typical test was inert-gas tungsten-arc welding .040-inch sheet in a square butt joint with no root opening. The joined was cleaned with a wire brush before welding. One pass was made with filler wire of the same composition as the base metal. The base metal was solution heat treated at 1950°F before welding. Argon shielding gas was used in the torch (30 cfh), in the backup (10 cfh) and in the trailing cup (20 cfh).

continued on page 56

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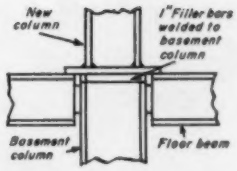
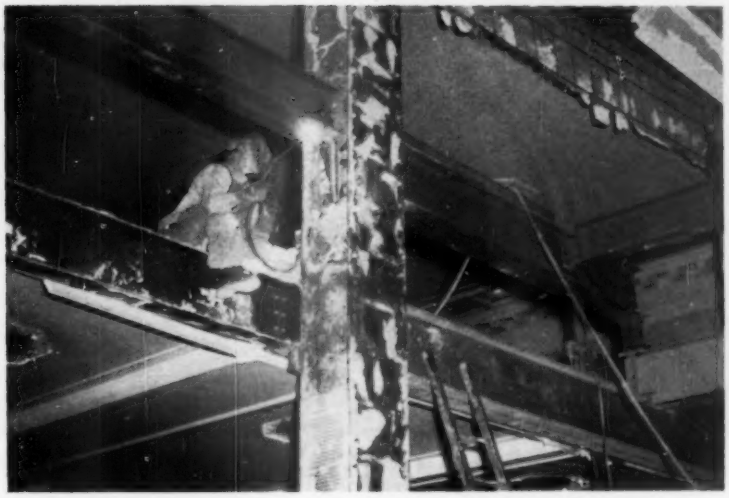


STRUCTURAL T's welded to basement columns (left) raise their load capacity from 90 to 150 lb. per sq. ft. This makes them strong enough to support 65 tons of new steel (below) used in remodeling.

a 65-ton structural steel skeleton as a . . .



Strengthened Building Supports New Steel

IN BRIEF: A facelift operation to provide modern quarters for a TV station in an old building posed many structural problems. Here's how they were solved.

ANYONE PASSING Cleveland's old East Ohio Gas Building wouldn't guess that 65 tons of structural steel is going up behind its broad brass doors. They're actually erecting a new building inside an old one.

The steelwork is a big part of *Operation Facelift*, a project to provide new quarters for radio and television station KYW. It looks like an everyday job. But the architects, Jack Allen Balosky & Associates, and the structural engineers of the fabricators and erectors, the Standard Steel Company, found differently.

They studied the building to see how much facelift material it's structure could support. It wasn't much. Riveted columns designed for 90 lb. per square foot loads wouldn't be strong enough for new steel, tons of building material, sets and props, and heavy TV equipment.

Then there were the balconies on either end of the 180 by 100-foot room. They were hung from third-floor trusses with four steel rods. Their fronts were also anchored on four columns resting on the building's foundations.

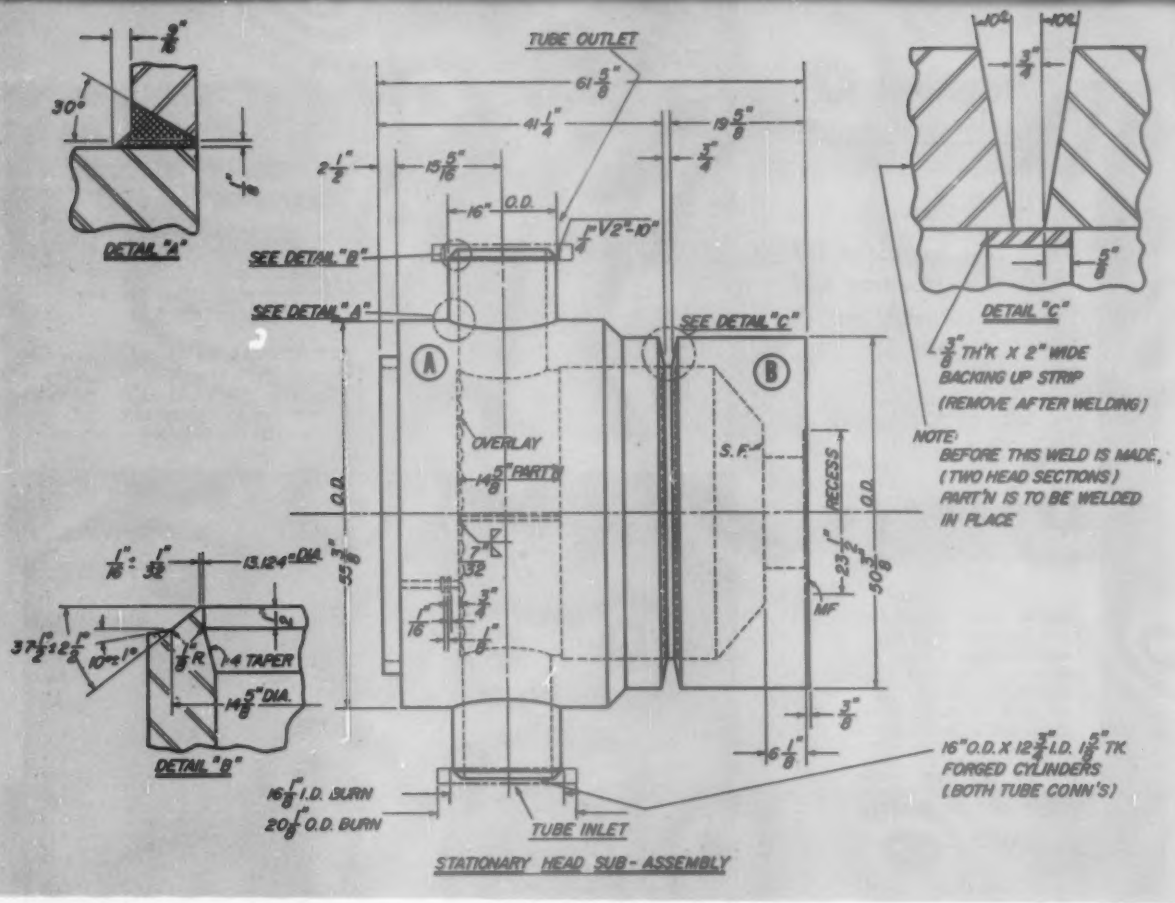
Hanger rods, of course, have no place in modern building. The balconies had to be supported, not hung. This meant more weight on the old frame. And unless reinforced, the overloaded columns would deflect, the old riveted connections shear, and the whole floor would drop into the basement.

So, the old riveted plate-and-angle columns had to be strengthened. They had to be strong enough for loads of 150-pounds per square foot instead of 90.

Stiffening the old columns with structural T's did the trick. The T's, made by flame cutting 14-foot lengths of 18-inch I-beams in two, were welded on opposite sides of the web plates of the columns, between foundation and first floor. The T's were 2 feet short, top and bottom, to clear the old riveted connections.

The welds joining the T's were ⅜-inch fillets about 3 inches long, on 12-inch centers. They were made on

continued on page 57


TUBE OUTLET
DETAIL "A"
SEE DETAIL "B"
SEE DETAIL "A"
SEE DETAIL "C"
OVERLAY
PART 'N'
S.F.
RECESS
MF
O.D.
DETAIL "B"
DETAIL "C"
3/8" TH'K X 2" WIDE BACKING UP STRIP (REMOVE AFTER WELDING)
NOTE: BEFORE THIS WELD IS MADE, (TWO HEAD SECTIONS) PART 'N IS TO BE WELDED IN PLACE
16" O.D. X 12 3/4" I.D. 1 5/8" TK. FORGED CYLINDERS (BOTH TUBE CONN'S)
16 1/8" I.D. BURN
20 1/8" O.D. BURN
TUBE INLET
STATIONARY HEAD SUB-ASSEMBLY

Joint Design And Welding Procedures Are Keys To Fabrication Of Feedwater Heaters

IN BRIEF: Here's what one company does to get high quality welded joints in feedwater heaters used in electric generating stations.

WELDED DESIGN has a key role in fabricating feedwater heaters at Griscom-Russell Co., Massillon, Ohio. The company designs these heaters for horizontal and vertical installation, for all capacities and pressures. Their line runs from the small low-pressure heaters for moderate-sized plants to the extremely high-pressure jobs for electric generating stations. Feedwater heaters, by the way, take steam from the turbine to add heat to the boiler feedwater as it passes from the main condenser hot well to the boiler.

DESIGN BACKGROUND

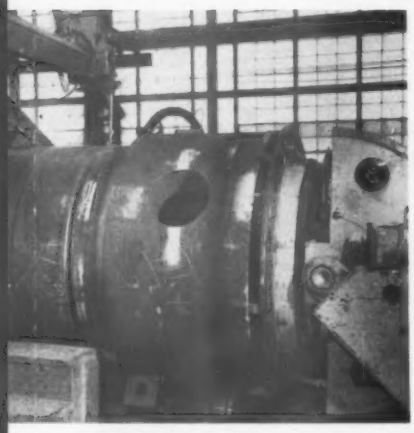
When you design a feedwater heater, the main thing is to transfer the heat, completely and efficiently from the steam in the shell to the water flowing through the tubes. To do this, you have to arrange the tubes and baffles so they distribute the steam evenly and not at an unduly high velocity. You also have to allow for draining off condensed steam and for venting noncondensable gases. It takes skillful design to prevent vibration of the tubes, to assure ample strength of parts, tightness of joints, ease of inspection, cleaning and replacing of parts.

In one design, the water side of the heater requires flanged connections. All the tubes are welded to a sheet. That makes it possible to pull the tube bundle from the shell. In another design, the welded connections are required on the water side of the heater. The shell connections are flanged, operate under higher pressures. With this arrangement its easier to remove the shell for inspection. It's lighter than the head-and-tube bundle assembly.

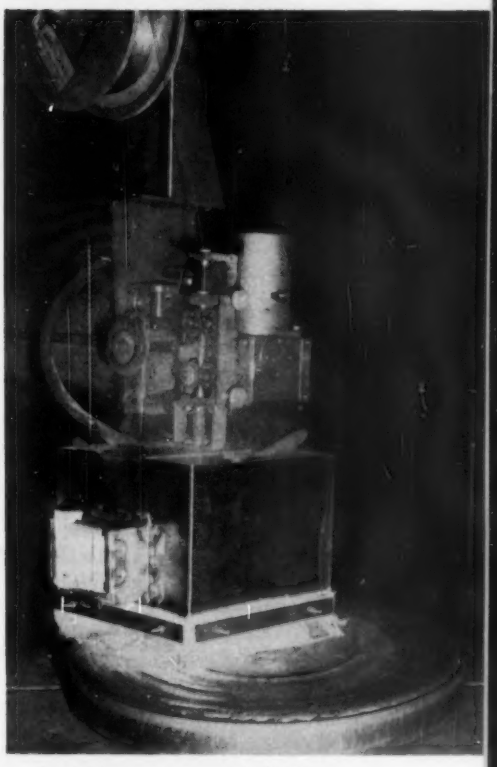
STATIONARY HEAD WELDMENT

A typical weldment is the stationary head sub-as-

INSPECTED feedwater heater is ready for shipping.



SUBMERGED ARC process makes girth weld in stationary head subassembly.



SPECIAL FILLER WIRE (#60 Monel) is used to make overlay on test sample (left). Special welding head, controls and manipulator (right) give automatic control.

sembly shown in the detailed sketch. The bulk of it consists of two heavy forgings made of ASME-SA 266 grade B Steel. Section A, the larger forging, weighs about 6 tons. Section B, the smaller, weighs about 4 tons.

A great deal of welding and fabricating goes into the stationary head subassembly. G-R said that it took a lot of testing and development, using different welding and fabricating methods, before they were able to get quality, economical production.

First they had to develop a way to deposit overlay on the inside face of Section A. The sketch and photo shows the overlay surface. G-R bought a new welding manipulator to do the overlay job. Special controls and a special head were put on the manipulator. They were designed to give automatic control of the weld at all times. From the photo of the test sample you can see a distinct, uniform jog at the end of each weld cycle and the start of a new overlay. After they developed the jogging and overlapping they had to develop the weld procedures to give them a quality overlay.

OVERLAY PROCEDURE

Griscom-Russell got the best overlays with consummable inert arc. For the first pass they used a #61 nickel filler wire as a buffer at currents of 180 to 200 amps, 25 volts and 25 to 30 ipm travel. For a shielding trailer gas they used a purge or argon at 10 c.f.m. and a torch flow of 35 c.f.m. Before they make a second pass they preheat to 200°F. They preheat the head to 200°F before any overlay is done. For the second pass G-R uses #60 monel filler wire, currents 180 to 200 amps, 26 to 28 volts with same travel speed and gas flow. The third and final layer is of #60 monel filler wire.

The overlay deposit must be applied right the first time. Why? Because they have to join sections A and B that make up the head subassembly. Once this is done there is no going back. It is very difficult to get a welding head in from the outside opening of the stationary head subassembly. The depth to the surface is about 50-inches, and the hole opening is small. They had to design a special adaptor for the welding head to feed the filler wire into the 36-inch deep well of Section A.

STATIONARY HEAD FABRICATION

Before sections A and B are girth welded together (see joint design for details), they fit up and weld a partition to section A. Next they stress relieve the section. After that, they drill, groove and ream the tube holes. Then they weld sections A and B. G-R tack welds a $\frac{3}{8}$- by 2-inch-wide back up ring to get a 100% weld. With submerged arc it took them about 100 passes to fill the weld cavity. They X-Ray the multi-pass welds as they go along. To weld the $4\frac{1}{2}$-in-thick section they used a multi-pass granular flux and a $\frac{1}{8}$-inch high-manganese electrode. This job took two

FEEDWATER HEATERS

continued from page 55

men. They used 700 amps, 36 volts and welding speeds of 12 to 16 ipm.

After making the girth weld they X-rayed it 100 percent. They weld on the tube inlet and outlet connectors and protective rings. The connectors are forged cylinders—16-inch O.D. x 12¾-inch I.D., 1⅝-inch-thick. Protector rings are 1½-inch-thick, flame cut to 20⅛-inch O.D. and 16⅛-inch I.D. They come off before final testing.

Next they stress relieve the stationary head subassembly in a furnace. After that, they horizontal drill tube holes to final size, groove, and reream.

Finally, they drill and tap for tie rods and final machine the stationary head subassembly.

TEST REQUIREMENTS

Boiler feedwater heaters operate at about 750 psi fluid pressure and 825°F. The metal shell side operates at about 650°F, and tube side at 3,000 psi pressure at 575°F. To insure quality in production Griscom-Russell makes these tests on all heaters.

They use air to check tube to tube sheet welds before they roller expand tubes into tube sheet.

They use fluorescent dye test on tube to tube sheet weld, and magnaflux welds at skirt and stationary head.

After stress relieving they hydrotest each tube weld to 6,000 psi for 5 seconds.

Finally, they X-ray the unit complete, spot X-ray long seams of shell and girth seams, full X-ray stationary head, skirt long seams and girth seams for the second time. • •

WELDING NEW NICKEL ALLOY

continued from page 50

The welded specimens were heat treated at 1400°F for 16 hours and at 1650°F for four hours. The specimens were then tested in tension and in bending. Rohr compared the results.

All specimens tested in bending were bent without failure 150° over a .560-inch radius.

The tension tests also showed uniformly satisfactory results, with strengths running well over specifications. (See accompanying charts.) In heavier material, such as ½-inch plate, the pattern was found to be much the same. However, the fracture almost always took place in the parent metal.

The ultimate test of operators' skill was making a cruciform sample without the fixtures normally required for welding such a difficult part.

FORMING

Rohr found that Rene 41 could be formed with conventional methods at the hardness levels needed in airframe components.

MACHINING

Milling tests showed machining Rene 41 would be

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More than two years intensive field testing by hundreds of users on heavy construction and production welding have demonstrated that these air-cooled holders let welders turn out more weld footage . . . safely, comfortably . . . stand up under the hardest use. Call or write for full information on KoolGrip electrode holders.

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For More Information Circle No. 54 on Reader Service Card.

costly but could be done without too much difficulty. Because of the alloy's structure, milling had to be done on machines which provide maximum rigidity. The alloy work hardens rapidly. This means speeds and feed must be low, but cuts must be big and kept moving. Cutter life was found to be low. Several solvents proved better than conventional coolants.

Drilling and counterboring was done successfully. But, tool wear again was a problem. A friction saw proved to be best for rough cutting. • •

OPERATION FACELIFT

continued from page 53

both sides of the joint with AWS E6010 electrodes. An engine-driven welder supplied the current.

Now that the main floor had good legs, the balconies needed columns to replace the hanger rods. Since the hanger rods were plumb with the basement columns, the new columns had only to be stacked on top of the old. The problem was how to get them the right length so that they would support the balcony without a wall-cracking sag.

Bill Rambeau, Standard's erection superintendent, knew how. He brought the H-beam columns in long and the base plates loose. Then they jacked up the balcony ½ inch higher than level with four-100-ton hydraulic jacks. Then they cut away the hanger rods. The extra ½-inch gave Standard the length of the columns (plus plates) and clearance to slip them in place. Then they lowered the jacks until the balcony rested firmly on the columns, and welded the columns to the base plates.

Before installing the new columns, 1-inch bars were welded to the old ones to transfer the load (see sketch). Otherwise, the new columns would bear on the old floor beams and overload them.

The same technique of extending the reinforced columns to support the old balconies was used to support a new balcony along the front of the room. The new balcony connected the other two.

Standard welded and fabricated all new structural members in its Cleveland shop. Operators who had passed the city code test did the welding. The test consisted of welding fillets in flat, vertical, and overhead positions, proving with x-ray that the welds were sound.

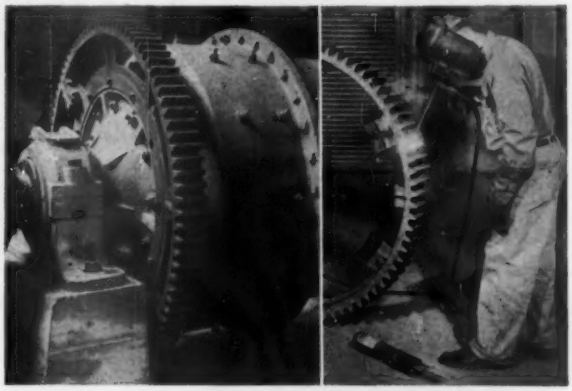
All the KYW facelift fillets are ⅜-inch. And everyone of them will have to have the okay of the city's inspector. That's why you see Standard's operators taking extra pains with each weld.

Into the erection went 1200 feet of weld. Beams connecting the old columns were welded to them. First, they welded gusset-and-plate supports to the columns. Then the beams were set on them and angle clips welded first to the column, then to the beam web. New beam-column connections were made with high tensile bolts.

Erection time, from start to finish, will be four weeks. When KYW takes over their modern quarters, few will know what it took to get it that way. Odds are the decorator and the furnisher will get all the credit. • •

Colmonoy Hard-Surfacing Makes Spur Gears Last Thirty-five Times Longer

Spur gear life of 5000 hours is now obtained by the operator of the ball mill shown, instead of a previous gear life of only 140 hours. The reason for this tremendous jump in service life: The application of Colmonoy No. 2 hard-surfacing electrodes to the gear teeth. And it costs less to hard-surface a worn gear than to buy a new one!



Gear wear was accentuated because this mill processes hard compounds, causing extremely abrasive particles to fall on the meshing gear teeth.

Protecting spur gear teeth by arc welding deposits of Colmonoy No. 2. These low-hydrogen DC electrodes weld fast, require low amperages.

Wherever excessive metallic wear exists, there is an opportunity to cut costs. You know where such wear exists. Colmonoy sales engineers know what to do about it. Call one. Or write to Detroit about your problem part.

Ask for Colmonoy Hard-Facing Manual No. 79.

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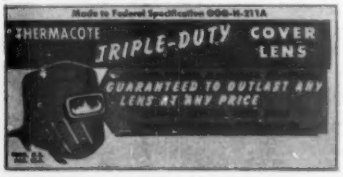
Thermo Filter Plates guaranteed to have less variation in density. Blue-green tint eliminates fatigue and eye-strain.

Laboratory tests prove Sta-Kleer All-Plastic Cover Lens last longer because they are more heat and scratch resistant.



Triple-Duty Glass Coated Cover Lens outsell all others on the market because they repel molten weld slag. Will not peel or discolor.

THERMACOTE COMPANY
108 So. DeLacey Ave., Pasadena, Calif.

Circle No. 80 on Reader Service Card.

REFERENCE DATA *catalogs, handbooks, manuals*

VERTOMATIC WELDING EQUIPMENT for electroslag welding is the topic of a 4-page bulletin issued by Arcos Corp. Literature describes the Vertomatic machine as well as comparing the electroslag process with submerged arc welding. A table showing variables used on welds of different material thickness is included. Also given are mechanical properties of welds made with composite wires on samples which were not heat treated. **For More Information Circle No. 92 on Reader Service Card.**

A "HOW-TO" WALL CHART in color from American Manganese Steel Division gives step-by-step instructions for replacing tractor grouser bars. It also includes detailed ordering information for manganese or carbon steel bars covering all leading makes of tractors. A similar chart provides instruction and specifications covering two types of dipper tooth repointer and repointer bars. **For More Information Circle No. 93 on Reader Service Card.**

A NEW FOLDING POCKET CARD from Linde Company, Division of Union Carbide Corp. presents in tabular form the physical property equivalents of some cryogenic fluids. The cryogenic fluids treated are those most useful to engineers in the chemical and missile industries. **For More Information Circle No. 94 on Reader Service Card.**

"ELECTRODE POCKET GUIDE" is the title of a 64-page booklet just issued by Air Reduction Sales Co. Included in the booklet is complete information on all types of electrodes available from Airco; application data, procedures and pertinent AWS-ASTM data is given for each. Ask for form ADC 650. **For More Information Circle No. 95 on Reader Service Card.**

AN UP-TO-DATE BROCHURE from Tempil Corporation lists the company's complete line of 80 temperature ratings of Tempilstiks and of Tempilaq covering the range from 1130°F to 2500°F in systematically spaced intervals. Ninety temperature ratings for Tempil Pellet are listed in ratings up to 2700°F. **For More Information Circle No. 96 on Reader Service Card.**

ADVANTAGES OF MECHANIZED hard facing is the subject of a booklet issued by Haynes Stellite Company, Division of Union Carbide Corp. Featured is a complete line of mechanized hard facing equipment and materials available from Haynes. Machines are materials for five types of hard facing are discussed in the 24-page book. **For more information Circle No. 97 on Reader Service Card.**

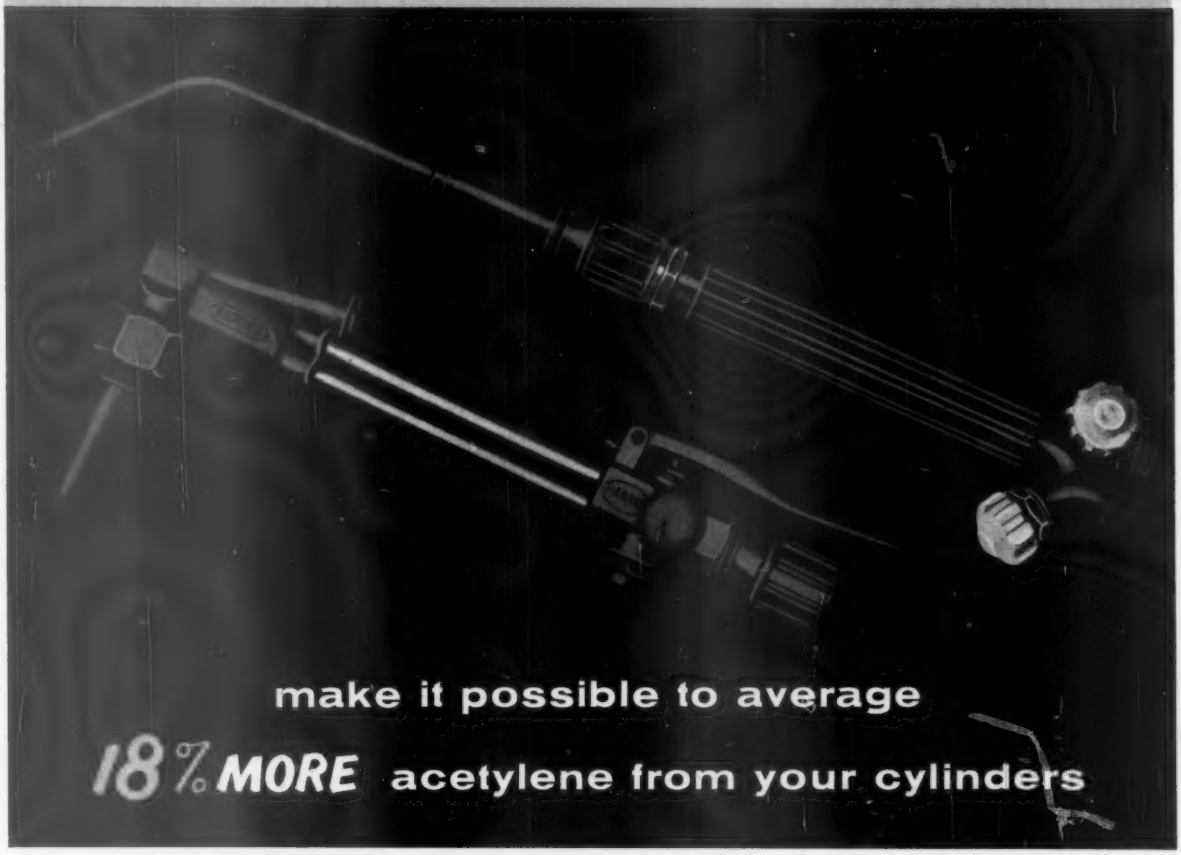
GAS WELDING AND CUTTING apparatus are featured in the new 16-page catalog of "Rego" equipment issued by National Cylinder Gas Division of Chemetron Corp. The publication also lists and describes industrial gases distributed by NCG. **For More Information Circle No. 98 on Reader Service Card.**

COMPLETE STANDARD DESIGNS and specifications for stud welding fasteners are included in a new book published by KSM Products, Inc. The book also describes the stud welding system and gives complete engineering data. The book is available on letterhead request only from KSM in Merchantville, N. J.

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

HARRIS

universal pressure welding torch No. 43 and the No. 49 cutting attachment will



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USEFUL LITERATURE *continued*

FREE FLUX SAMPLES are available from Krembs & Company, manufacturer of 25 different welding, brazing and soldering fluxes. Write for yours on company letterhead. Use Reader Service Card for literature.

Circle No. 42 on Reader Service Card.

COMPLETE LINE OF CLAMPS for a variety of pipe welding jobs are featured in literature offered by Jewel Manufacturing Co. Described and illustrated are pipe, elbow, angle and flange clamps.

Circle No. 41 on Reader Service Card.

TEMPERATURE INDICATING crayons, liquids and pellets are featured in literature offered by the Markal Company. Company's "stiks" are available for every temperature from 113°F to 2000°F. Liquids and pellets are used for inaccessible or hard-to-measure applications.

Circle No. 46 on Reader Service Card.

THREE CASE HISTORIES in which the success of welding was due to the use welding electrodes and wires made by McKay Company are featured in a new 8-page folder. Featured are the welding of a crane's dip-stick, the welding of custom steel castings and the use of semi-automatic welding to cut costs in manufacturing drag-line buckets.

Circle No. 100 on Reader Service Card.

AN AIR-COOLED electrode holder is the subject of literature offered by J. B. Nottingham & Co., Inc. The Kool-Grip holder is said to permit a full shift of welding with only one holder.

Circle No. 54 on Reader Service Card.

A NEW PORTABLE welding screen that enclosed the job on all four sides is the subject of a new 5-page circular issued by Singer Glove Mfg. Co. The new circular also shows a complete line of curtains and drapes, asbestos blankets and heavy woolen blankets.

Circle No. 63 on Reader Service Card.

THE *NEW* VIEW FOR WELDERS!

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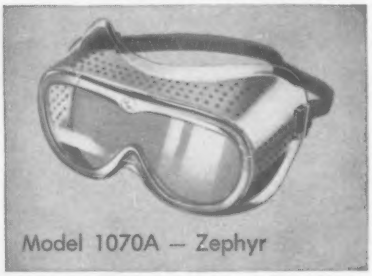

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Circle No. 19 on Reader Service Card.

A BIG, EFFICIENT blowtorch for all kinds of heat treating and production processes is featured in a bulletin offered by Clements Mfg. Co. Complete operating characteristics and design details are given for the Model K blowtorch which operates on natural or manufactured gas.

Circle No. 18 on Reader Service Card.

ELECTRODE STABILIZING ovens and how they can be used keep electrodes dry by preventing moisture pick-up is the subject of an illustrated brochure from Phoenix Products Co. A complete line of ovens are described and illustrated in Bulletin DR 658.

Circle No. 56 on Reader Service Card.

SIX GAS CYLINDER carriers are described in a bulletin (NM-199K) available from National Cylinder Gas Division of Chemetron Corp. The three larger carriers are for single cylinders and have two, three and four wheels. The smaller carrier accomodate one, two and six "D" or "E" cylinders.

Circle No. 102 on Reader Service Card.

STRESS RELIEVING of welded joints with a portable 400-cycle induction heating unit is available from Hobart Brothers Co. Folder DM-117 explains the principle of high frequency induction heating and answers questions about its use for stress relieving welded joints.

Circle No. 103 on Reader Service Card.

FIBRE GLASS WELDING HELMETS are described and illustrated in Bulletin 35-H issued by Sellstrom Mfg. Co. The bulletin explains the firm's new nylon lift front and stationary plate retainers and its new ratchet headgear.

Circle No. 104 on Reader Service Card.

CRYOGENIC EQUIPMENT for storing, handling and transporting low temperature liquid gases is described in a new 16-page bulletin available from Standard Steel Corp. The two-color publication presents photographs and typical specifications.

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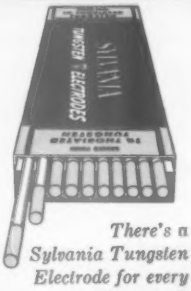

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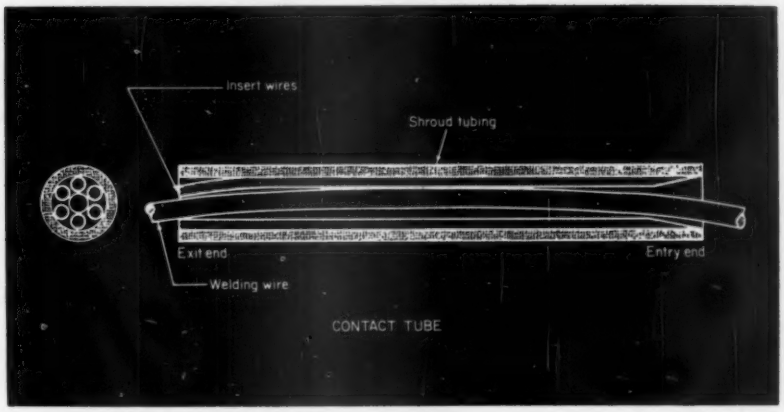
the high burn-off rate and rapid oxidation of this metal led to these . . .

Developments In Consumable Electrode Welding Of Magnesium

BY C. R. SIBLEY, *Air Reduction Sales Company*



WELDING WIRE passing through this new contact tube is wiped by a series of wires fastened to the entry end. This provides good electrical contact, even when the welding wire is heavily oxidized.

IN BRIEF: All-position consumable electrode welding of magnesium is just around the corner. Here's how the problems that stood in the way are being solved.

TWO CHARACTERISTICS have held back gas-shielded metal arc welding of magnesium. One characteristic is that the magnesium filler wire burns off too fast. The other: Oxide forms rapidly on the wire and prevents good electrical contact.

High burn-off rates will force high welding speeds. But there is no advantage in speed if poor fusion or porous deposits result.

OXIDE IS POOR CONDUCTOR

Oxides on magnesium filler wire increase surface resistance and restrict the passage of welding current to the welding wire. One method of preventing oxide formation is to coat the wire with a protective conductor. The coating would not only increase the wire's shelf life, it would make it a more uniform product. Another solution, mechanical cleaning, hasn't been too successful. Chips collect and jam the wire feeding device.

Our company studied ways to eliminate the oxide and burn off problems. The first one was solved with an electrical contact tube of completely new design. The second showed that it is possible to reduce the burn-off rate of magnesium.

The old style contact tube is a heavy-wall, copper-alloy tube having an inside diameter slightly larger than that of the filler wire. To make good contact with the tube, the wire passing through it must be curved. The wire contacts the tube at the exit end. And any shift in the location of this contact will result in unstable arc.

When the filler metal is oxidized it makes poor electrical contact with the tube. This often results in irregular wire feed and a wild arc. Neither of these conditions will produce quality welds.

Our engineers tried to improve the electrical contact by modifying the contact tube. They bent the exit end of the tube. They also fitted the exit end with

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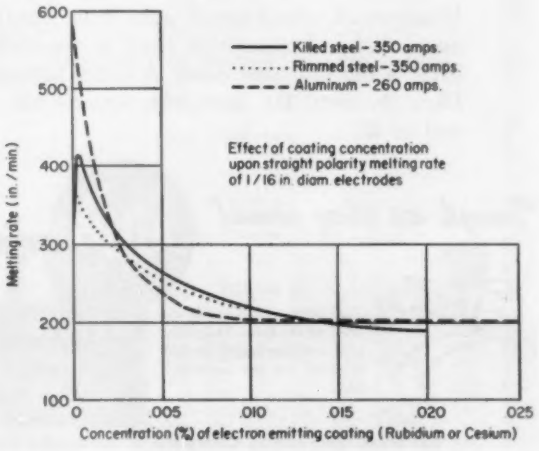

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MAGNESIUM WELDING

continued from page 63

a pressure shoe. Neither worked—so they designed a new tube.

WIPING ACTION EFFECTIVE

The new contact tube has several wires, fastened to the entry end, which wipe the filler wire as it passes between them. This increases the number of points of electrical contact and produces a stable arc, even with heavily oxidized magnesium wire.

Our studies have shown that the burn-off rate of magnesium can be reduced. The melting rates of aluminum and steel have been reduced by coating the wires with materials that emit electrons. The emission of electrons in the arc keeps the filler wire from over-heating. This reduces the rate of melting. The same melting rate reduction can be expected for magnesium wire as for aluminum.

COATING EMITS ELECTRONS

The more emissive material put on aluminum and steel wires, the more their burn-off rates are reduced—to a point (see graph). At this point there is no further reduction of burn-off rate.

When a commercial method has been found for applying a uniform and controlled amount of emissive materials on magnesium wire, the use of consumable electrode welding will sharply increase. With a lower melting rate, the process can be used for all-position welding of magnesium—just as successfully as aluminum. • •

All-State Expands Los Angeles Facilities

WHITE PLAINS, N. Y.: All-State Welding Alloys Co. is expanding its Los Angeles facilities, according to T. D. Nast, All-State president. The company has moved into new facilities at 4954 Firestone Blvd., doubling the space previously available. A feature of the new operation, according to Mr. Nast, is automatic welding-wire spooling machines designed for maximum tension control and level layer application.

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15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255	271	287	303	319	335
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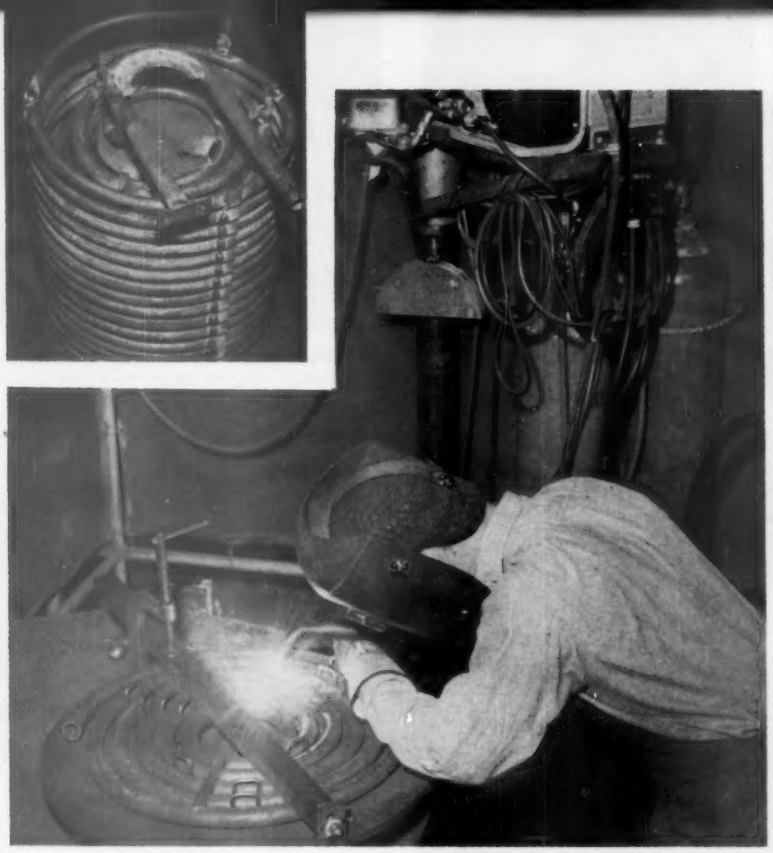

WELDING TIME for joining support straps to steam coils was cut in half; argon consumption reduced 40%. Inset shows steam coil assembly with U-shaped thermal tube.

New Welding Process Saves $5,000 A Year In Labor, Shielding Gas

IN BRIEF: Semi-automatic welding has replaced two manual processes in welding steam generator components; large savings have resulted.

CLAYTON MANUFACTURING Company of El Monte, California, has cut welding time in half in the production of steam generators and cleaning equipment with the installation of a new Linde Company consumable electrode welding torch. The new torch, designed for high-speed welding of thin-gage materials, now handles two welding operations in fabricating steam coils for these units.

JOINS DISSIMILAR METALS

The first welding application is the fabrication of thermal tube assemblies. These assemblies automatically shut off the fuel supply when the steam coils or other components overheat. A ¼ by ½-inch brass expansion ring is welded to standard ½-inch mild steel tubing using 0.030-inch silicon bronze wire, and pure argon to shield the weld puddle.

Clayton also finds that the new torch saves time in the welding of steel support straps to the "pancake" layers of steam coils. Here ⅝ to ¾-inch wide 10 gage mild steel straps, varying in length from 6 to 14 inches, are consumable electrode welded to the coil tubing. Steel wire, 0.020 inches in diameter, and a gas flow of 75% argon and 25% carbon dioxide are used in this welding operation.

The old way of joining support straps was with tungsten arc welding. By using the new consumable process the welding time was cut from 14 to 7 minutes per unit. A further saving: the amount of argon shielding gas was about 40% less than consumed with the tungsten arc process.

Total yearly savings resulting from the switch to the new process for both applications was $5,000. Of this, $4,000 was in labor savings and $1,000 in reduced argon usage. • •

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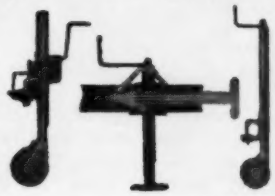

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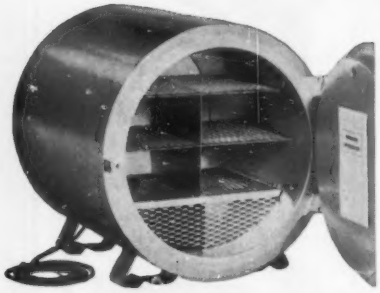

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THREE-PASS OVERLAY of iron-base alloy is applied on worn crusher jaw over build-up deposit of EFeMn-A alloy.

CRUSHER JAW (left) shows effect of abrasive service in grinding refractory brick. Jaw at right is surfaced and will last five times longer.

FLIGHT FACES of foundry sand screw are surfaced with ⅛-inch deep, one-inch wide overlay of iron base alloy. Surfacing cut replacement costs a startling 94 percent.

Surfacing increases wear resistance of austenitic manganese steels

by **MILTON C. PARSON,** *research metallurgist, Wall Colmonoy Corp.*

IN BRIEF: Strong, ductile and impact-resistant manganese steels resist wear longer when protected by an iron-base hard surfacing alloy.

AUSTENITIC MANGANESE STEEL is used mainly in machines subject to extreme wear: Rock crushers, grinding mills, dredge buckets, power shovel buckets and earth moving equipment. When work hardened, this steel resists metal-to-metal wear and is used for sprockets, pinions, gears and conveyor chains.

Manganese steel has remarkable resistance to impact. It also has very high strength with good ductility. However, it is only wear resistant to a degree when compared to the abrasion-resistant hard surfacing alloys. On bucket teeth, for example, hard surfacing alloys usually outwear manganese steel by 2½-to 3-times. On other scouring applications where manganese steel has not been work-hardened by impact, the hard surface overlay will outwear unprotected base metal by as much as eight times. Therefore, a hard surface overlay can substantially increase the utility of austenitic manganese steel.

Manganese steel (Hadfield's alloy) containing from 10 to 14 percent manganese and 1.0 to 1.4 percent carbon (ASTM Designation A-128-33) is austenitic when water quenched from about 1850°F. Its as-quenched hardness is about 185-210 BHN. When work-hardened, the hardness goes as high as 550 BHN (56 Rockwell). Internal stresses from quenching and the reduction of mechanical properties at the center of heavy castings limit practical maximum section thickness to about five or six inches. Stresses that develop during cooling in the mould, will often produce cracks prior to heat treating.

The relatively high austenitizing temperature (1850°F) and the high

carbon content may cause some decarburization and less of manganese at the surface. This results in the formation of a martensitic skin. This skin is more brittle than the underlying metal and is liable to cause a crack, resulting in failure of critically loaded thin-section parts.

Prior to hard surfacing, consider the possible existence of a layer of martensite or work-hardened material. This layer can be quite harmful because of its magnetic properties and brittleness. It may have to be removed by grinding before surfacing. Work hardened manganese steels embrittle rapidly upon reheating because of the formation of a precipitated carbide. In some critical resurfacing applications-drag chains and railroad trackwork—the work-hardened metal layer should be removed by heat treating at 1850°F and quenching. If this is not practical, grind off the work-hardened layer. A center punch mark provides a crude, but convenient index to work hardening. Continue grinding until a deep indentation can be made easily.

IRON-BASE ALLOY

I recommend an iron-base hard surfacing alloy for making an abrasion-resistant overlay on manganese steel. Several alloys of this type are available as composite electrodes in a variety of chemical compositions. Each provides a wide range of physical, metallurgical and mechanical properties. They permit selecting an alloy to meet varying requirements of abrasion- and impact-resistance and economy.

Use a conventional DC electric arc with reverse polarity to apply these alloys. The composite electrodes consist of a steel core wire with a coating. This coating contains the hard surfacing alloy constituents and the necessary arc stabilizers, fluxes, etc. I prefer the metalic arc over the oxy-acetylene torch because it does not heat the manganese steel base material enough to seriously impair its toughness.

Use the skip welding method to deposit a short bead no wider than 2½-times the electrode diameter and about two-or three-inches long. Then run another bead at some distance from the first. In the case of small parts, and on bucket teeth of large parts, you may have to go on to another part or tooth to allow cooling

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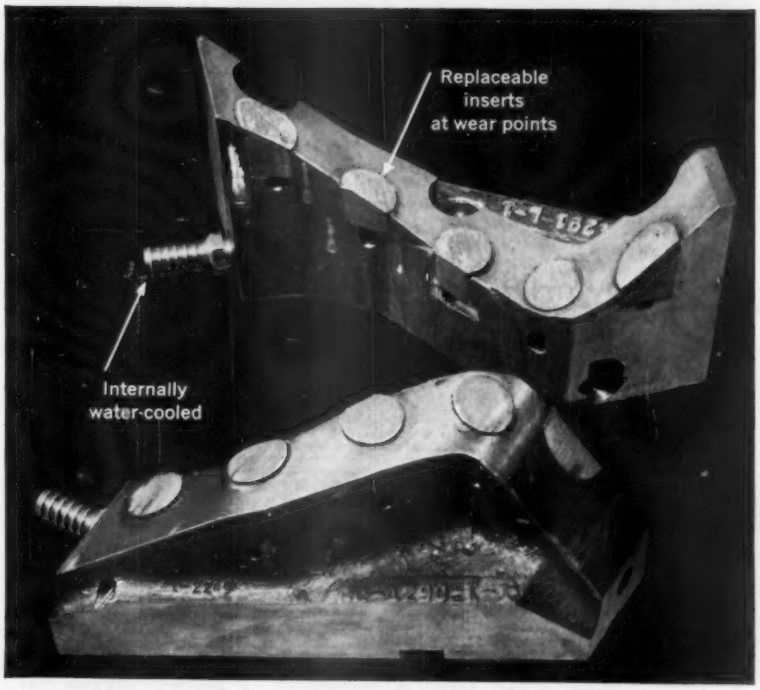

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Originally, the projection welding die shown here was cast to contour in one piece and not internally water-cooled. Its life was short. Replacement was expensive, in terms of both money and downtime.

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off between bead applications. Use the lowest possible current setting to minimize heating the base metal.

Composite electrodes require somewhat more heat than regular full fluxcoated steel electrodes of the same diameter. For example, the amount of current may be as much as 30 amperes more for a typical ¼-inch electrode.

The alloy used depends on the part being surfaced and how it is used:

On shovel teeth, digger teeth and bucket lips where the overlay must withstand severe sudden shock and abrasion, you will usually use an ironbase alloy containing 0.9 carbon, 11.0 chromium and 2.5 boron. These deposits contain both chromium borides and chromium carbides (for abrasion resistance) suspended in a tough iron alloy matrix (for impact resistance).

On coal chutes and scraperblades where impact is less severe—but where abrasion is extreme—use an iron base electrode containing 1.0 carbon, 13.0 chromium and 3.0 boron. The high amounts of these alloys produce higher percentages of chromium borides and chromium carbides The result is a deposit having excellent abrasion resistance. Although some impact resistance is sacrificed, the alloy is usable in moderate to heavy impact applications.

AVOID OVERHEATING

In applying the hard surfacing alloy, avoid preheating the base metal above 500°F. Why? Austenitic manganese steel becomes quite brittle when heated in the range of 500°F to 1600°F. This brittleness is caused by carbide precipitation.

Follow this procedure and take care to avoid localized overheating. The results will be satisfactory. You'll get a very good bond between the iron base surfacing alloy and the manganese steel base metal. The structure of the base metal will not be affected materially.

When the part is subjected to direct, severe impact, there is always the possibility of a failure by fracture. In situations of this kind, it is often more practical to apply the iron-base alloy on top of a build-up layer. This layer is made with build-up electrodes conforming to AWS-ASTM classification EFeMn-A (covered) or EFeMn-B (bare).

The coated electrode is a nickel-containing austenitic manganese steel. The bare electrode is a molybdenum-containing austenitic manganese steel. Both have a lower carbon content than regular austenitic manganese steel. This lower carbon content—along with the alloying element—inhibits the formation of the carbide precipitate. This minimizes the possibility of brittleness upon cooling in the 500° to 1600°F temperature range during overlaying with iron-base surfacing alloys. This means you don't have to take the strict precautions you do when applying the iron-base electrode directly to the manganese steel base metal.

When heavy overlays are needed to resist extreme wear, first overlay the surface to be repaired with EFeMn-A (coated) or EFeMn-B (bare) electrodes. Leave about 3/16 to 3/8 inch maximum for the final layer of iron base surfacing alloy. EFeMn alloys are applied as follows:

Prepare the surface the same way you would if you were going to apply the iron base alloy. Hold the preheat of the base manganese steel below 500°F. Apply the EFeMn alloy by skip welding. In addition, peen each welded bead while still hot. Clean beads with a wire brush.

AMPERAGE SETTINGS

Use these settings for applying various diameters of EFeMn-A coated electrodes: 1/8-inch, 50-70 amps; 5/32-inch, 70-100 amps; 3/16-inch, 100-140 amps; 1/4-inch, 140-175 amps. Use DC reverse polarity. The result: A deposit with a hardness of about 20 Rockwell C, one which will work harden to as high as 54 Rockwell C.

A typical EFeMn-B bare electrode (semi-automatic wire) comes in 50-pound coils of 12-inch ID with a wire diameter of 7/64-inch. The maximum recommended current for this wire is 200 amps, DC reverse polarity. This produces a deposit having a hardness of about 13 Rockwell C. It will work harden to as high as 51 Rockwell C. • •

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FOR YOUR CONDITION, I PRESCRIBE REPLACEABLE TUFFCAP TIPS

Mushroomed spotweld tip? Don't throw it away! Toss out the worn end . . . re-use the shank! You can when you use replaceable TUFFCAP TIPS and long-life TUFFALOY SHANKS.

Get the Tuffaloy Catalog and Price List. Write or call your nearest Airco or Tuffaloy office.

TUFFALOY.

AIRCO

AIR REDUCTION SALES COMPANY
A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.
Air Reduction Pacific Company • Air Reduction Canada Limited

Speed-Up WELDING
WITH SUPERIOR'S BENCH MODEL
POSITIONER-TURNTABLE

LOW PRICE • HIGH QUALITY

Holds work in any position from vertical to horizontal and will carry 100-pound load.

Smooth, stepless speed change, both forward and reverse, from zero to 6 rpm—greater speed if desired. Ideal for aircraft work.

Reduces rejects—increases output up to 25%. Gear driven motor, v-belt transmission with tension control, built-in ground for more uniform welds.

Good Distributor territories still open • Write for details

For additional information, write or wire to:

SUPERIOR WELDING CO.
3410 E. 14th St., Los Angeles 23, Calif.

Circle No. 68 on Reader Service Card.

FOR BETTER, CLEANER, STRONGER, JOINTS

ANTI-BORAX

SAFE - NON TOXIC

WELDING & BRAZING

FLUXES

V CHECK THIS COMPLETE LINE FOR ALL YOUR NEEDS

- ☐ 1. Cast Iron Welding Flux
- ☐ 2. Brazing Flux for Brass, Bronze, etc.
- ☐ 4. "Braz-Cast" Flux for Bronze Welding Cast Iron
- ☐ 5. Aluminum Flux for Cast Aluminum
- ☐ 8. Aluminum Flux for Sheet Aluminum
- ☐ 9. Stainless Steel Welding Flux
- ☐ 11. Tinning Compound
- ☐ 15. Welding Flux for Magnesium Alloys
- ☐ 16. Silver Solder Paste Flux for Silver Brazing

Order "Anti-Borax" Fluxes By Number

Manufactured Only By
ANTI-BORAX COMPOUND CO., INC
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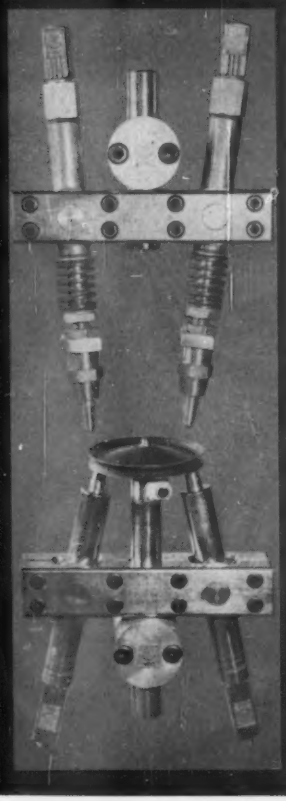
For More Information Circle No. 61 on Reader Service Card.



S-M-S

Adjust-A-Angle Adapters with Adjust-A-Pressure Holders solve many welding problems

Change from one electrode spacing to another in a matter of minutes—with the same set-up.

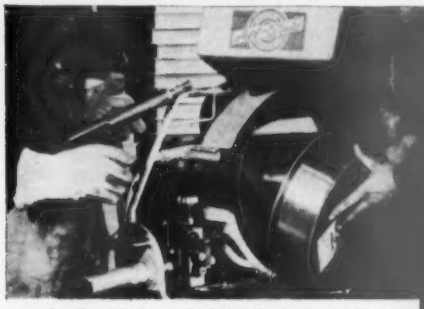
FREE: Write for descriptive data on complete line of resistance welding products.

Another step to better welding.

S-M-S Corporation

2254 Cole Avenue

Birmingham, Michigan



Loading 10 lb. spool of #4043 aluminum wire at Michael Flynn Manufacturing Co., Philadelphia. Aluminum in this particular spool was used in welding curtain walls for skyscraper at 2 Broadway, New York City.

now you can get All-State Spoolarc®

SPOOLED ALUMINUM

in all grades, all types precision layer level wound on 1 lb. and 10 lb. spools

Wire goes from extrusion and light draw to ALL-STATE'S precision spooling machines where it is layer level wound for smooth, trouble-free welds.

Types available: 1100, 4043, 5052, 5154, 5183, 5356, 5556, 6061, 6063, *355,* 356, 716, 718.

Precision spooled in these sizes: .030, .040, 3/64, 1/16, 3/32, 1/8.
*down to 1/16 only

ALL-STATE *Spoolarc*® spooled aluminum wire meets federal and industry specifications. Spools are sealed in polyethylene bags plus desiccant to retain top quality from spooling machine to welding machine.

Complete stocks available from factories at White Plains, N. Y. and South Gate, California . . . and from branches at St. Louis, Missouri and Toronto, Canada. On sale at over 1000 distributors here and abroad.

Send for new free Aluminum Manual.

Distributor-Stocked, convenient to buy. Economical to use.
ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.
Call WHite Plains 8-4646 or write for nearest distributor

For More Information Circle No. 3 on Reader Service Card.

Champion Discontinues Mild Steel Electrodes

CLEVELAND, OHIO: The Champion Rivet Company will terminate the domestic production of mild steel electrodes on April 1st. The company said the move was based on the opinion that increased welding of jet-age materials will make it impossible for manufacturer to concentrate on making both specialty and mild steel electrodes.

Champion will continue to market a complete line of electrodes for welding low-alloy high-tensile, high alloy, stainless, tool and Croloy steels. The company will also continue to offer fabricators complete consulting and research services.

NEMA Committee Works On Government Specs

CHICAGO, ILL.: The Arc Welding Section of the National Electrical Manufacturers Association will help prepare new and revised arc welding apparatus specifications for federal and military requirements. The decision was made here at a recent meeting.

The work will be done by a Technical Committee which will review and develop recommendations in cooperation with federal and military bodies.

The Section's next meeting is scheduled for Pittsburgh on March 17.

Baltimore Distributor Announces Name Change

BALTIMORE, MD.: A. C. Earlbeck, president of Earlbeck & Landrum, Inc., one of Baltimore's oldest and largest welding supply distributors, has announced a change in company name to Earlbeck Welding Supplies, Inc. The change was made to identify the company more closely with the welding industry. No changes have been made in ownership, management or personnel.

Airco Builds New Sales Office

CHARLOTTE, N. C.: Air Reduction Sales Co. has started construction of a new $100,000 sales office and warehouse here at 2300 South Boulevard. The facility is now located at 124 West Third Street.

Circle No. 1 on Reader Service Card.

Curtiss-Wright Sponsors Radiography Course

PRINCETON, N. J.: Five day courses will be given in industrial radiography and ultrasonic inspection at the Nondestructive Testing Laboratories here at Curtiss-Wright's Princeton Division.

A five-day radiography course will begin on Monday, February 22, and a five-day course in ultrasonic inspection will start on Monday, March 14.

For further details contact Bruce W. Smith at Curtiss-Wright Corp., Box 110, Princeton, N. J.

Lenco, Inc. Purchases Assets of Pike Products

JACKSON, MISSOURI: Lenco, Inc., has purchased all the assets of Pike Products, Inc., formerly known as H. J. Wagner Products Co., according to Paul Leonard, Lenco president.

Lenco will resume manufacturing of the Pike products. These will be marketed under the Pike name along with Lenco's present line of Hi-Amp welding accessories.

General Mills Takes Over Magnaflux Corp.

MINNEAPOLIS, MINN.: General Mills, Inc., has acquired the business and assets of Magnaflux Corp., Chicago, Illinois, pioneer in nondestructive testing. The firm will continue its business at its present location in Chicago and under the same name as a wholly-owned subsidiary of General Mills. Key officers and personnel will be retained in their present positions.

RWMA

continued from page 14

of concern to RWMA and to help fill the need for adequate instruction in the fundamentals of the various processes, RWMA cooperated with International Correspondence Schools in the development of a complete course in resistance welding.

The RWMA has a very active Technical Committee. It is an industry Leader and sponsors intensive research and educational activities.

For More Information Circle No. 25 on Reader Service Card.

Flood FIBER GLASS WELDING HELMETS
For Safety, Comfort and Economy

These seamless fiber glass units (of thermo-setting, polyester resin) are compression-molded and stoutly reinforced to afford maximum protection. All are fitted with the new Fit-Rite, snap on, ratchet type headgear—the most comfortable, durable and easiest-to-maintain you can buy, and not more expensive.

NEW DESIGN ADVANTAGES
1. Lighter weight for more comfort.
2. A smoother and stronger shell.
3. Easier cleaning and sterilizing.
4. Non-warping moisture-proof construction.
5. Superior resistance to heat.

No. 51-8F-2H

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Enjoy real savings with Flood's
1000-HOUR COVER LENS
Outlasts 125 glass lenses. Reduces eye fatigue. Safer because shatter-proof.

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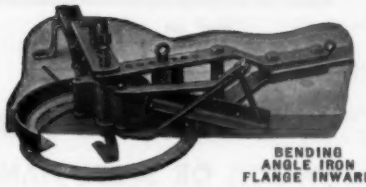
See Your Distributor or Write:
Flood Always FINEST QUALITY FAIRLY PRICED
FLOOD SAFETY PRODUCTS CO.
3037 WEST LAKE STREET, CHICAGO 12, ILLINOIS

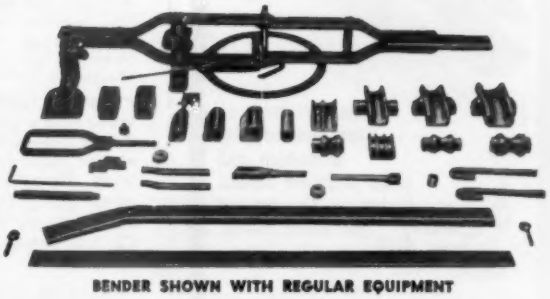
HOSSFELD # 2 Universal® Iron Bender Bends


BENDING ANGLE IRON FLANGE INWARD

ROUNDS
FLATS
SQUARES
BAR STOCK
ANGLE IRON
PIPE
TUBING & CONDUIT (RIGID OR THINWALL)

35 Years Of Metal Bending Experience

- Wrenchless, it's ready to use.
- Practical, it's quickly set up.
- Adaptable, it replaces special equipment.
- Versatile, 147 different dies are available.
- Dependable, it's a "must" for maintenance and limited production work.
- Invaluable, optional hydraulic equipment makes the job easier.
- Indispensable, it's as necessary as a shop vise.


BENDER SHOWN WITH REGULAR EQUIPMENT

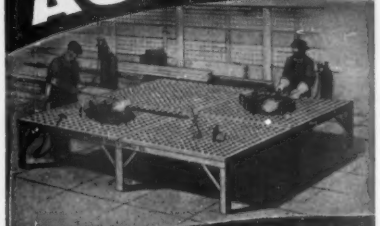
FREE! WRITE FOR BENDER BULLETIN

HOSSFELD MFG. CO.
436 W. THIRD STREET • WINONA, MINNESOTA

For More Information Circle No. 36 on Reader Service Card.

Circle No. 1 on Reader Service Card.

ACORN



BENDING BLOCKS
or
WELDING PLATENS

Semi-steel Blocks for layout, welding assembly work, etc., with machined working surfaces; also tools and accessories, including a full line of clamps, drift pins and dogging devices. Standard and special stands can be supplied. A 4-unit set-up, joined and mounted on stands, is shown above.

WRITE TODAY FOR LITERATURE

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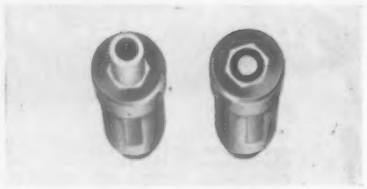
Delaware Avenue at Poplar Street
Philadelphia 23, Pennsylvania



Cable Connector

A welding cable connector that won't overheat or arc and joins securely with a twist of the wrist has been developed by Ampco Metal, Inc. A patented eccentric-locking or wedging action is said to provide an efficient electrical contact—preventing overheating. Normal wear increases the contact area, extending service life.

The new connector has no moving parts. It has a molded neoprene cover and has soft copper sleeves to permit cable attachment by either lead soldering or crimping.

Two sizes are available: Model 120 for 1/0 and 2/0 cable and Model 340 for 3/0 and 4/0 cable.

Circle No. 111 on Reader Service Card.

Electrode For Hard-To-Weld Steels

An electrode for joining crack-sensitive and hard-to-weld steels has been introduced by Certanium Alloys and Research Corp. Known as Certanium 707, the electrode deposits reach 120,000 psi tensile, 90,000 psi yield, and 35% elongation.

A 707 deposit consists of a balanced austenite-ferrite ratio which tends to prevent crack formation.

Circle No. 112 on Reader Service Card.

Handy Bench Shear

A new bench shear has been introduced by Edwards Manufacturing Co. The new portable Edwards Handy #1 bench shear will cut sheet steel up to 3/32" thick, nonferrous metals, rods up to 5/16", wire, leather, paper, or stainless steel. Cutting blades are easily removed and resharpened. The tool is built for production purposes, tool and die work, and template work. It cuts with one stroke leaving no burrs.

Circle No. 110 on Reader Service Card.

INTRODUCING THE PRECISION-BUILT
NON-MARRING STEEL LIFTING CLAMP

- Smooth ground jaws
- Five to one lifting ratio
- Wedge screw adjustment
- No teeth

Where marring of stainless, copper, aluminum and other polished metals is a factor, we recommend Safety Snap Lock the above clamp.

Write for catalogue

J. C. RENFROE & SONS, INC.
1926 SPEARING STREET
JACKSONVILLE, FLORIDA

Circle No. 57 on Reader Service Card.

CHIPPING HAMMERS

7 Styles to Choose From

WOOD OR STEEL HANDLES

TYPE A—Drift and Chisel. Wood handle, tool steel. Popular in malleable iron and grey iron foundries for general chipping. Also for cleaning torch cuts. Weight 20 oz.

TYPE CB—Triple Duty. Wood handle. Combines 3 tools in 1—drift, chisel, and removable wire brush. Weight 16 oz.

TYPE C—Drift and Chisel. Same as Type CB but without brush. Weight 14 oz.

TYPE E—Head made of high-grade ¾" square tool steel, steel handle combination drift and chisel. Special hand grip absorbs shock. Weight 16 oz.

TYPE EB—Identical to Type E except fitted with rugged replaceable cleaning brush. Weight 18 oz.

TYPE F—Similar to Type E, except head has two chisels at right angles. Weight 16 oz.

TYPE FB—Same as Type F except fitted with replaceable cleaning brush. Weight 18 oz.

ORDER FROM YOUR WELDING SUPPLY DEALER

CHICAGO MANUFACTURING & DISTRIBUTING COMPANY
1934 West 46th Street CHICAGO 9, ILLINOIS

For More Information Circle No. 83 on Reader Service Card.

Work Holder

The "Handy Hand" is a new positioning device developed by Superior Welding Co. for holding small work pieces while welding, soldering and assembling. The device holds about three pounds of job weight rigidly in any desired position.

A wide range of clamps, including magnifying glass and magnetic holders, are available. Existing special shop tooling fixtures are easily adaptable by attaching a 5/16-inch spud for the revolving head.

Circle No. 69 on Reader Service Card.

Welding Rod Carton

A new, colorful and convenient package has been developed by Rankin Mfg. Co. for three of its welding rods. Ranite No. 4 gas rods and Rantung gas rods and electrodes will be packaged in five pound cartons having steel-reinforced corners. They are also available in attractive 50-pound shipping cartons.

Circle No. 113 on Reader Service Card.

Portable AC Welder

A new, low cost, 68-pound, portable, 180 amp AC welder with guaranteed high output is now being made by Emerson Electric Mfg. Co. The new welder has a guaranteed output (78 open circuit voltage with 75 percent factor) from six conveniently located 60-through-180 amp heat taps.

The unit is light and compact, measuring 21¾- by 14¼- by 10-inches.

Circle No. 114 on Reader Service Card.

Complete your shop with this modern metallizing installation

WIRE GUN
Sprays any metal that can be drawn into wire form.

POWDER GUN
Sprays hard-facing alloys and ceramics in powder form.

Without metallizing no maintenance or "job" shop can offer the same complete service as the shop that uses industry's low-cost "putting-on" tool.

With modern, low-cost metallizing equipment you can spray carbon steels, stainless, babbitts, brass, bronze, nickel, aluminum, tin, zinc, special hard facing alloys including tungsten carbide.

- **Save up to 90% of replacement costs on machine repair jobs**
- **Do your own hard-facing at high speed, low cost**
- **Apply long-wearing, corrosion-resistant coatings**

A real opportunity for the smaller shop

Thousands of large, well-known companies and shops have been metallizing users for many years, not only in maintenance work but in production applications on original equipment. Now, with modern low-cost metallizing equipment this high-speed "putting-on" tool is within the reach of even the smallest shop.

FREE BULLETIN

Send off the coupon for detailed information — find out how a metallizing installation can pay for itself in a very short time. No obligation, of course.

Metallizing Engineering Co., Inc.
1179 Prospect Ave., Westbury, L. I., New York

Please send me free bulletin on metallizing.

Name _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____

Metallizing Engineering Co., Inc.
1179 Prospect Ave., Westbury, L. I., New York · cable: METCO
In Great Britain: Telephone: EDGEWOOD 4-1300
METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England

For More Information Circle No. 50 on Reader Service Card.

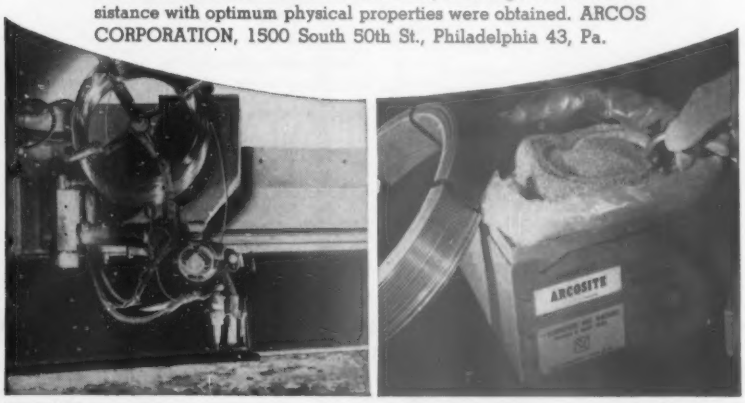
Job Report Courtesy of
Alco Products, Inc., Schenectady, N. Y.

Nuclear pressure vessel stainless clad at low cost

USE ARCOS

STAINLESS WIRE and BONDED FLUX

This "barrel" is one of several that comprise a nuclear pressurizer to operate under highly corrosive conditions. To reduce costs, Alco Products forged the shell of ASME A-336, 2—4 inch thick manganese molybdenum steel and clad the inside with stainless. The illustration shows the second pass overlay which was made by submerged arc using Arcos Chromenar K-LC (Type 308) bare wire and Arcosite S4 flux. Lower cost, and high corrosion resistance with optimum physical properties were obtained. ARCOS CORPORATION, 1500 South 50th St., Philadelphia 43, Pa.



Bare Wire Arcosite Flux

For More Information Circle No. 81 on Reader Service Card.

Non-Marring Lifting Clamp

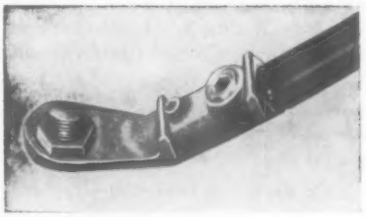
A new lifting clamp designed to lift stainless steel, copper, aluminum and other polished metals has been announced by J. C. Renfroe & Sons. Known as Model NM, the clamp's jaws are smooth ground but have a tremendous grip with a three-to-one safety factor due to a finger-adjustable wedge on one side of the jaw. The clamp is made in weight-lift sizes ranging from ½ to 12 tons.

Circle No. 115 on Reader Service Card.

New Hydraulic Shears

A new line of metal cutting shears that are hydraulically powered has been developed by the Steelweld Machinery Division of the Cleveland Crane & Engineering Co. The shear is different from other hydraulic shears in two ways: the blade is powered by a single hydraulic cylinder which provides high speeds needed for lighter thicknesses and the blade is pivoted and turns in a curved path.

Circle No. 116 on Reader Service Card.

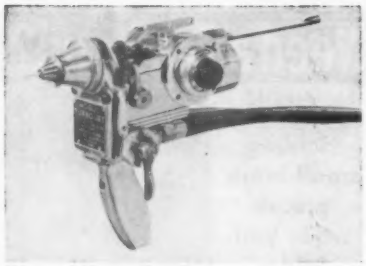


Ball-Point Lug

A new mechanical lug that can be quickly and easily attached to stranded welding cable has been announced by Tweco Products, Inc. Made of high conductivity copper, the lug barrel is tapered to accept a cadmium plated steel, ball-point screw. The screw is driven with a hex wrench.

Lugs come in two sizes to handle from No. 4 thru 4/0 cable. They come with or without fibre insulating cover.

Circle No. 117 on Reader Service Card.



Ceramic Spray Gun

A high-pressure, high-velocity spray gun for applying ceramic coatings to metal and other non-porous surfaces has been developed by Metallizing Co. of America. The gun applies an even, fine mist of protective coating that can be built up to specified dimensions.

Coatings are applied by automatically heating the tip of a solid ceramic rod in the spray gun. The molten ceramic particles are then sprayed at high speed to objects or parts being coated. Three types of rods made by Norton Company (aluminum oxide, zirconium oxide and zirconium silicate) are used.

Circle No. 118 on Reader Service Card.

All-Weather Welders

New arc welders completely weather-proofed against rain, cold, heat and even salt spray have been introduced by the National Cylinder Gas Division of Chemetron Corp. The "Sureweld" DRH series of horizontal DC rectifier welders are said to be the first horizontal direct-current units built to withstand rough handling and adverse weather.

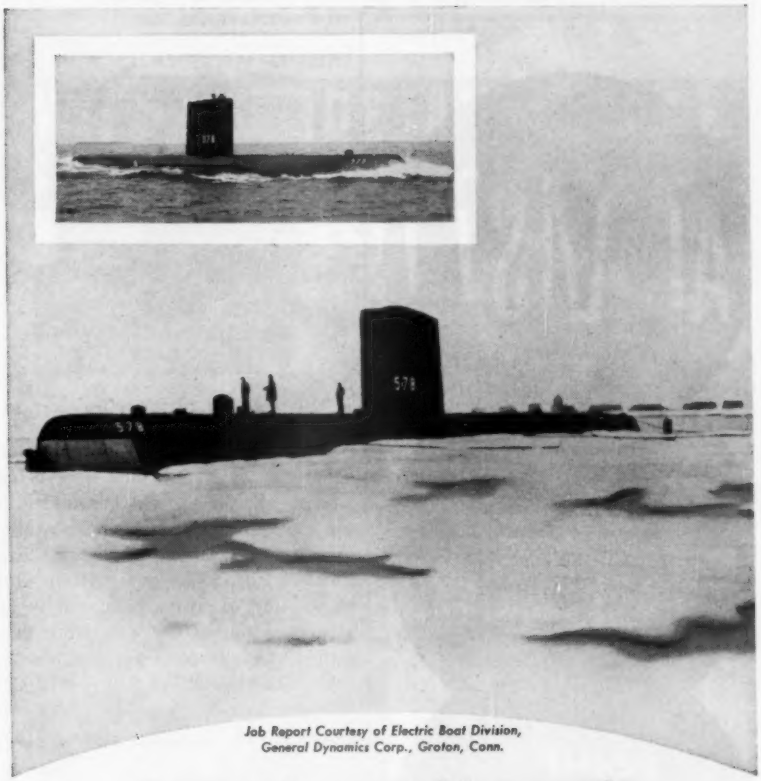
Three models available are rated at 200, 300 and 400 amps.

Circle No. 119 on Reader Service Card.

Low Temperature Kits

Designed to protect rods and solders for joining aluminum, iron, copper and their alloys, and to make them easy to identify, are new counter-top kits introduced by All-State Welding Alloys Co., Inc. Rods are packed in transparent, flexible, and shatterproof plastic. Each kit is complete with descriptive material on alloy characteristics, application method and typical uses for each alloy.

Circle No. 120 on Reader Service Card.



Job Report Courtesy of Electric Boat Division, General Dynamics Corp., Groton, Conn.

For maximum weld strength at sub-zero temperatures

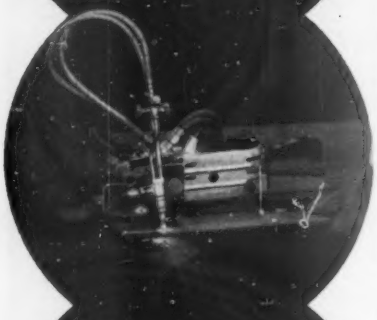
WELD WITH ARCOS

LOW ALLOY ELECTRODES

The Skate (above), as well as the Nautilus, Seawolf, Swordfish, Skipjack and Triton are among the "greats" in America's atomic powered sub force carrying welds produced by ARCOS low alloy electrodes. ARCOS Tensilend 80, 100, 120 and Ductilend were used to assure welds of highest possible impact strength whether on missions in the tropics or the sub-zero arctic. When you need weld metals with similar qualities, ARCOS is well worth remembering. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

For More Information Circle No. 82 on Reader Service Card.

AT LAST!



REALLY A PORTABLE OXYGEN CUTTING MACHINE

INEXPENSIVE • LIGHTWEIGHT
ECONOMICAL • VERSATILE

The Messer "Quicky" Pays for Itself!

Where can you use the new Messer "*Quicky*" cutting machine — now available in the United States for the first time.

The *Quicky* is perfect for cutting plate from ⅛ to 2½ inches. Yet it weighs ONLY 13 POUNDS!

You'll be amazed at the quality of this machine. Yet its low price means you'll get real savings when you use the versatile *Quicky*.

GET FULL DETAILS NOW! Send information card or write us direct for free booklet.

MESSER CUTTING MACHINES, INC.

WELDING ENGINEERING Messer SINCE 1898

CHRYSLER BLDG., 405 LEXINGTON AVE., N. Y. 17

Circle No. 45 on Reader Service Card.

NEW PRODUCTS *continued*

Portable X-ray Unit

A power of 300 KV, penetration capability of 4" steel and a carrying weight of 150 lb. are combined in the Baltograph 33, a new, portable unit recently announced by Balteau Electric Corp. The new unit is said to provide accurate radiography in all power ranges on parts from thin walled castings to heavy weldments. Unit measures 46-¼" long by 12-¼" in diameter.

Circle No. 121 on Reader Service Card.

Heavy-Duty Welder

A new line of a.c. welding machines in 200- to 500-amp capacities, for heavy-duty production work, has been announced by Metal & Thermit Corporation. Designated Types M20 to M50, these units are designed to NEMA standards for heavy-duty welding, and to provide good arc characteristics with a variety of electrode types and sizes. The welders feature: dual coil transformer, instant arc starting, forced air cooling, and a minimum-travel steel shunt.

Circle No. 122 on Reader Service Card.

Manual CO_2 Welder for Automated Production

Designed for manufacturing plants where production lines are automated, this new Auto-Special version of the CP C-OManual welding equipment package gives a finished weld which

Circle No. 69 on Reader Service Card.

Need a 3rd Hand?

for Holding small work pieces while you Solder — Weld — Assemble — Experiment — then —

Use the "HANDY HAND"

an ingenious labor-saving device that holds up to 3 lb. work pieces at any angle—rigid—yet easily and quickly moved to any other desired position; clamps to any 2" bench or table top. It's flexible and rotating positioning head gives complete flexibility in any and all positions.

DEALERS — Write for details.

For additional information write or wire to

Hold it with a "HANDY HAND"

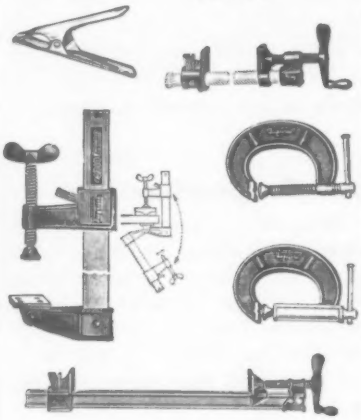
Manufactured by

SUPERIOR WELDING CO.

3410 East 14th Street
Los Angeles 23, Calif.

"Jorgensen" and "Pony" CLAMPS

Favorites in the industry for nearly sixty years. Write for free 32-page catalog.



sold through leading distributors

ADJUSTABLE CLAMP CO.

"the clamp folks"
419 N. Ashland Ave., Chicago 22, Ill.

Circle No. 2 on Reader Service Card.

may have a reinforcing rivet head or flat appearance as the application demands. The units, offered by A. O. Smith Corporation's Welding Products Division, consists of a 600-amp constant-potential power source with slope control, Stellarweld reactor, wire drive that feeds an electrode at an adjustable rate of speed, and a semi-automatic gun.

Circle No. 123 on Reader Service Card.

Safety Glasses

To help simplify safety glass inventory by providing glasses that will fit most users, Chicago Eye Shield Co. is offering Polyfit plastic frames with two universal features designed to do this job. The Polyfit bridge design fits most people comfortably. Nickel-silver temples are also interchangeable with most safety glasses equipped with 5-barrel hinges.

Tapered temples are available in two styles: cable or spatula. Flesh-tone plastic frames can be had with or without side shield. F7 shape lenses (46 by 39 mm and 48 by 41 mm) are removable for easy repair.

Circle No. 124 on Reader Service Card.

Remove Oxide Film From Aluminum

Oxide, scale and heat discoloration are removed from aluminum by a one-step method with Ox-Off #536 developed by Chemclean Products Corp. The new procedure is believed to be the only method of removing oxide in one-step by hand-wiping or dip-tank operation with a ready-made solution, followed by water rinse, all at room temperature. Surface-resistance tests show that the new method removes oxide completely.

Parts are wiped with a clean rag saturated in Ox-Off #536 and rinsed clear. Small parts can be dipped in the solution and rinsed, using as a dip tank polyethylene "Cubitainer" in which the solution is shipped.

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For More Information Circle No. 17 on Reader Service Card.

Quick-acting liquid

WIPES OXIDE AND SCALE from ALUMINUM, STAINLESS STEEL

Use OX-OFF 536 before or after welding to remove scale and oxidation from aluminum or stainless steel in seconds, without costly, time-consuming grinding, scratch-brushing, or sanding. Simply wipe oxide off metal with one or two strokes of hand applicator dipped in Ox-Off 536. Clean small parts by dipping in Ox-Off 536 . . . the polyethylene "cubitainer" in which we ship Ox-Off 536 is your dip tank.

Get free technical bulletins on removing oxide and scale from aluminum and stainless steel from your welding supplies distributor or

CHEMCLEAN
PRODUCTS CORPORATION
specializing in chemicals for cleaning, chemical polishing, finishing metals
15-08 121 Street
College Point 56, New York
Hickory 5-2330

QUIK HEAT

up to 2200° F.

CLEMENTS
Cadillac
MODEL K
BLOWTORCH

Here's a big, efficient blowtorch for all kinds of heat treating and production processes—yet it is completely and easily portable. Operates economically on either natural or manufactured gas. Produces heat up to 2200° F. in seconds! 1/3 h. p., Universal Motor. Sealed, precision ball bearings require no oiling. Equipped with metal stand, 10 ft. of gas hose and 20 ft. of reinforced rubber covered Underwriters' Approved cord with plug.

ask for **BULLETIN**

CLEMENTS MFG. CO.
6646 S. Narragansett Ave., Chicago 38, Ill.
SINCE 1910
INDUSTRIAL PRODUCTS DIVISION

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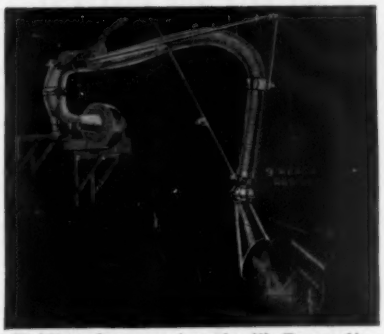
Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR



Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

WRITE FOR DETAILED INFORMATION

RUEMELIN MFG. CO.
3932 N. PALMER STREET • MILWAUKEE 12, WIS., U.S.A.
Mfrs. & Engineers • Sand Blast & Dust Collecting Equipment

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Arc Spot Weld Gun

MODEL G Pat. No. 2917618

SPOT WELDS FROM ONE SIDE

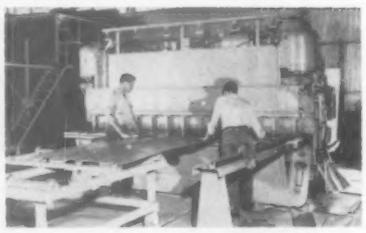
● Automatic Time Control

SHEET METAL • AUTO BODY WORK • SIGNS DUCT WORK • CABINETS • TANKS • PLUMBING ROOFING • SIGNS • NO EXPERIENCE NEEDED

STAINLESS STEEL ELECTRODES NOW AVAILABLE

- Many times faster than any other fastening method
- No distortion of metal
- Simple and safe to operate
- Precision-made for long, trouble-free use
- No electronic tubes in time control
- Requires no warmup period
- No welding experience needed
- Supplied with extra-small nose piece for narrow places
- Recommended for use with BREN/WELD Power Supply or BREN/WELD Arc Welder
- Weighs less than 2 lbs.

BREN/WELD
CORPORATION
Manufacturers of Welding Equipment
5114 Third Ave. • Brooklyn 20, N.Y. • HY 2-5300



Hydraulic Plate Shear

A new shear featuring "cut control" has been developed by Pacific Industrial Mfg. Co. Adjustment of rake angle, knife clearance, holddown hammering, holddown tonnage, back gauge setting and positioning permits the machine to cut 20 gauge to 3/8" plate without twist, bow or camber of light gauge metals, or marking of soft metals. Shear cuts at up to 70 strokes per minute by remote foot pedal.

Circle No. 125 on Reader Service Card.

Stainless Electrodes

Bren Weld Corporation, manufacturers of the Model G arc spot weld gun and Model 100 power supply, have announced that stainless steel electrodes for use with this equipment are available for immediate shipment.

Circle No. 126 on Reader Service Card.

Machine Welding Equipment

Air Reduction Sales Company has announced the introduction of two new Aircomatic heads, two controls and two machine barrels for use with the company's gas shielded metal arc welding process. Designed for versatility, various combination of heads, controls and barrels can be used to suit individual jobs.

The heads are single motor-driven units intended primarily for use with CAV and RAV power sources using ferrous and nonferrous aluminum and hard wires. The heads can also be used with conventional DC power sources with ferrous wire only. The heads can be used with argon, helium, mixtures of both, and with carbon dioxide shielding gases.

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BATEMAN BANTAM IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

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NEW PORTABLE SINGER SCREEN **PROTECTION ON ALL 4 SIDES**

NOW — a lightweight portable screen designed for complete enclosure. Easy, fast slip-joint assembly (no threads). Rust-proof finish. In 3 curtain materials: *JOHNS-MANVILLE ALUMINIZED ASBESTOS* cloth — the last word in protection . . . neoprene-coated *FIBER GLASS* . . . 12 oz. fire-resistant *DUCK*. All sizes. Also available in single and three-sided models. Ask your dealer or write us.

16 PAGE CATALOG
Complete line of work gloves, welding gloves and safety clothing.

Special Products Division
SINGER GLOVE MFG. CO.
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CHICAGO 22, ILL.

SEE OUR AD IN WELDING DATA BOOK

Circle No. 63 on Reader Service Card.

WE HAVE THE FLUX RIGHT For Your Job

62 years of experience in scientific development in welding

Whatever the particular job you have to do—we have the right FLUXINE you need. Besides our 25 FLUXINES we carry a complete line of "KOP-R-ARC" coated rods for welding copper and all copper alloys.

Write on company letterhead for chart and generous sample stating which FLUXINE desired.

KREMBS & COMPANY
(Est. 1875)
Dept. K, 669 W. Ohio St., Chicago 10, Ill.

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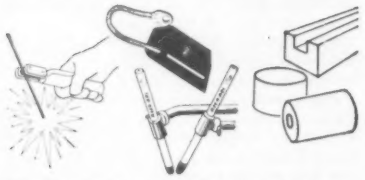
BECKER

HAS IT...OR CAN MAKE IT—

if it's CARBON or GRAPHITE!



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BRUSHES . . . for all motor and generator applications . . . carbon, graphite, copper leaf, gauze and metal-graphite.

WELDING ELECTRODES, WELDER BRUSHES . . . Keen-Cut Electrodes for carbon arc-air jet cutting . . . Keen-Arc Carbons, cored and heavily copper coated, for twin-arc torches . . . paste, rods and plates.

EXTRUSIONS, MOLDED SHAPES OR SPECIAL CARBONS designed and produced to your specifications.

COMPLETE BECKER ENGINEERING SERVICE
is always available and entails
no obligation whatever

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Telephone: BI 2-1260 · Chicago

IN 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding Foundation—and

MORT CLARK'S **GALV-WELD** ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959—23 YEARS LATER!

TIME PROVEN — MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 18 national magazines.

Mail Coupon Today

GALV-WELD PRODUCTS

Dept. WDF — Box 1303 — Bradenton, Fla.

Send Information User ☐ Distributor ☐
Dealer ☐ Free Sample ☐

Name .....

Address .....

City ..... State .....

Circle No. 28 on Reader Service Card.

CLASSIFIED

Cost of all ads in this section is $20 for the first inch and $15 for each additional inch or fraction. Rates for display ads in this section will be sent on request. All classified advertising payable in advance.

10 ARC WELDERS

Ten Westinghouse D.C. D.C. 200 Amp Motor Generator Arc Welders 230V D.C. Sacrifice $250.00 FOB Brooklyn, N. Y.

Weld-Arc Sales & Supplies, Inc
44 Bay Ridge Avenue
Brooklyn 20, New York

FOR SALE

One of Michigan's oldest and foremost welding supply distributors, presently servicing approximately 1000 active accounts. Own oxygen and acetylene cylinders. Has own delivery system. Holds franchises with leading welding supply manufacturers. Reason for selling: Owner wishes to retire. Approximately $100,000.00 down payment required. Interested parties write to P. O. Box No. 82, Alfred St. Station, Detroit 1, Michigan.

Hydraulic Tube Bender

Wallace Supplies Mfg. Co. has introduced a new hydraulic tube bender. The "Tubela" is an all-steel unit with a ram that develops eight tons of pressure through a manual hydraulic pump. The machine and six sets of bending dies and a straightening shoe come in strong metal cases.

The bending dies are said to be finished to a close fit for quality bends. Rapid power-return withdraws the work from the tight fitting dies.

Circle No. 128 on Reader Service Card.

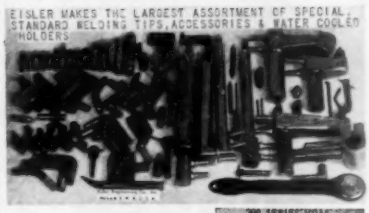
Face Shields

A new, low cost, light weight face shield (Spartan Series 6400) with polyethylene headgear, elastic headband and easy window installation has been announced by Welsh Mfg. Company. Adjustable elastic headband permits comfortable fit on any size head and can be worn low for additional comfort.

Circle No. 129 on Reader Service Card.

Circle No. 22 on Reader Service Card.

EISLER makes the largest assortment of **ELECTRIC SPOT, WIRE BUTT, SEAM, TWEEZER, GUN** and **FLASH WELDERS.** We also carry in stock a variety of **WELDING TIPS** and **ACCESSORIES.**



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735 So. 13th St., Newark 3, N.J.

TILLMAN

GLOVES-GARMENTS

WELDORS BUY FROM YOUR DEALER

WELDING GLOVES MITTENS AND GARMENTS NOW IN POLY BAGS

BRAZILIAN DEERSKIN THE "STAY SOFT" LEATHER GLOVES AND MITTENS

John Tillman & Company
1561 W. 19th St.
Long Beach, California

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You can't see it... but it saves you MONEY

HIDDEN CLUTCH DOUBLES gear and motor LIFE...

SANDER-GRINDER

Especially Built for the Welder. Perfect tool for grinding down welds, casting fins and risers. Milwaukee's *exclusive* coaster brake clutch drive absorbs backlash and shocks . . . doubling gear and motor life. Large cyclonic fan and specially designed exhaust ports provide extra ventilating capacity . . . cooler running. Totally enclosed grit-proof, dust-proof trigger switch. Powerful, no-stall MILWAUKEE motor delivers a full 1½ HP *at the spindle* . . . 5000 RPM . . . ball and roller bearings throughout.

See us at Booth 523
AWS WELDING & ALLIED INDUSTRY EXPOSITION
Great Western Exhibit Center, Los Angeles, April 26-28

Find Us Fast In The Yellow Pages
Look under "Tools-Electric"

Milwaukee Electric Tool Corporation
5318 West State Street • Milwaukee 8, Wisconsin

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THE HOLDER that *Can't Get Hot!*

the MODEL 600 "*Shortstub*"

Pats. Pend.

DESIGNED WITH PRIMARILY ONE PURPOSE IN MIND

- - to completely eliminate electrode holder heating - and the time and money lost by this problem . . . if you have hot holder problems you already recognize the dollars it costs in down time and in electrode waste.

NO WATER COOLING REQUIRED

The operator's hand is kept cool in two ways. One, the cable is brought directly to within a fraction of an inch of the electrode and does not pass through the handle of the holder. There is nothing in the handle that can get hot — it is completely empty. Two, the operator's hand is protected from the heat radiated from the arc and work-piece by a light-weight aluminum guard. The Model 600 "Shortstub" contains all of the many advantages of the standard Model #4 and #6 "Shortstub" electrode holders, such as the feature which reduces stub losses to the lowest possible minimum, the low cost renewable head feature and 100% safety insulation. The Model 600 "Shortstub" is not intended to replace every holder in your shop — but to be used only on those applications where holder heating is a problem.

SPECIFICATIONS AND PRICES

Capacity: 600 Amps, 100% Duty Cycle Length: 11" Weight: 28 oz.

1 to 11.....$15.70 each 12 and up .....$14.70 each

CALL YOUR WELDING DISTRIBUTOR OR WRITE FOR FORM SS600

PIONEER FOR BERNARD MODERN WELDING

BERNARD WELDING EQUIPMENT CO.

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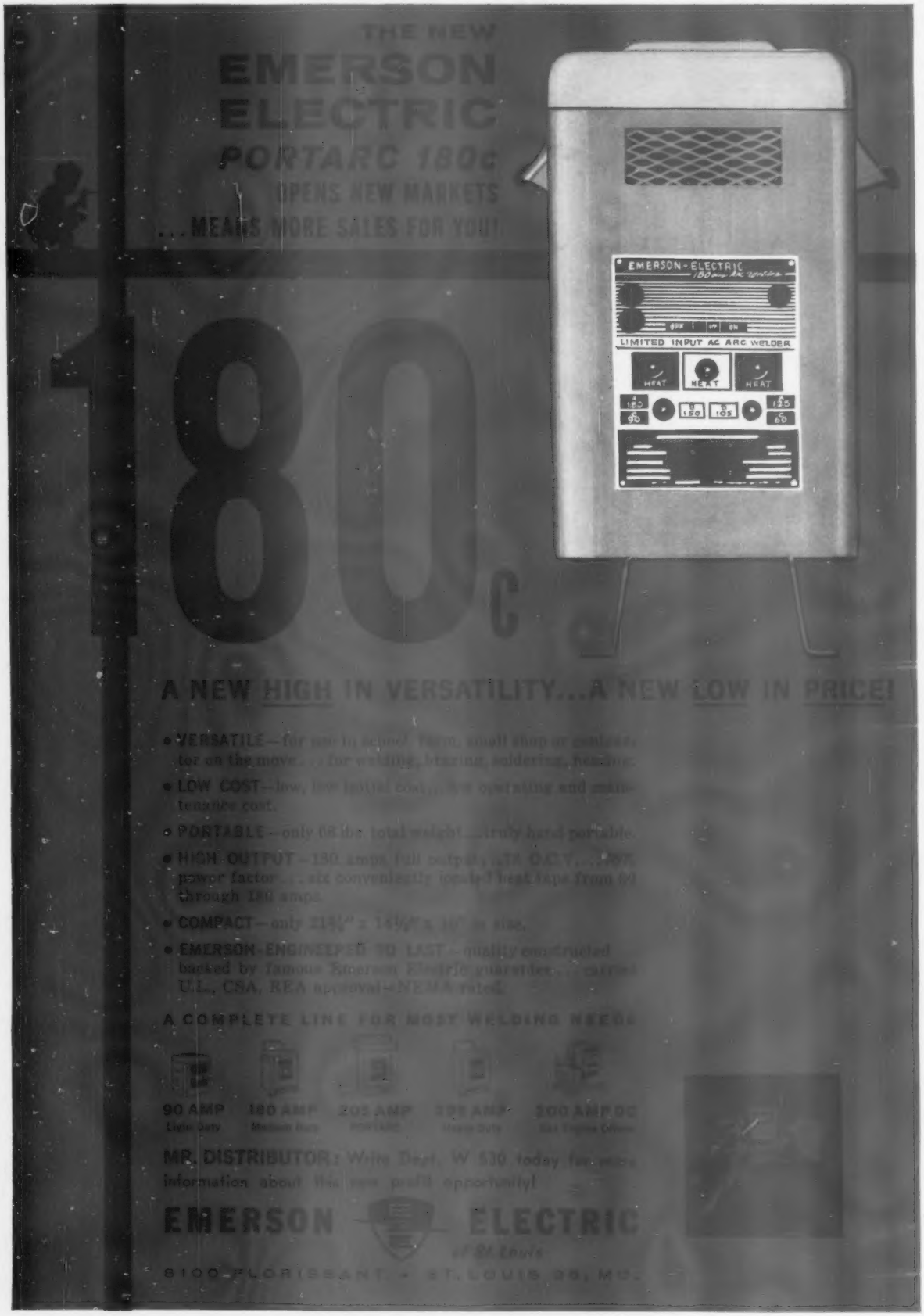

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